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THE VIRGINIA JOURNAL OF SCIENCE

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PROCEEDINGS FOR THE YEAR

1956 — 1957

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VIRGINIA ACADEMY OF SCIENCE

Proceedings for the Year 1956 – 1957

MINUTES OF THE THIRTY-FIFTH ANNUAL MEETING

MAY 8, 9, 10, 11, 1957

HOTEL CHAMBERLIN

OLD POINT COMFORT, VIRGINIA

LIST OF PRESIDENTS

Ivey F. Lewis	1923-24
*James Lewis Howe	1924-25
Robert E. Loving	1925-26
*J. Shelton Horsley	1926-27
*Donald W. Davis	1927-28
Wm. Moseley Brown	1928-29
Garnett Ryland	1929-30
L. G. Hoxton	1930-31
I. D. Wilson	1931-32
T. McN. Simpson, Jr.	1932-33
William A. Kepner	1933-34
William T. Sanger	1934-35
Ida Sitler	1935-36
H. E. Jordan	1936-37
D. Maurice Allan	1937-38
Earle B. Norris	1938-39
Ruskin S. Freer	1939-40
*Wortley F. Rudd	1940-41
George W. Jeffers	1941-42
*Marcellus H. Stow	1942-43
*W. Catesby Jones	1943-44
Robert F. Smart	1944-45
H. Rupert Hanmer	1945-46
Arthur Bevan	1946-47
Jesse W. Beams	1947-48
Sidney S. Negus	1948-49
Boyd Harshbarger	1949-50
Guy W. Horsley	1950-51
Paul M. Patterson	1951-52
Lloyd C. Bird	1952-53
Allan T. Gwathmey	1953-54
Irving G. Foster	1954-55
Walter S. Flory, Jr.	1955-56
Edward S. Harlow	1956-57
William G. Guy	1957-58

* Deceased.

Virginia Academy of Science

OFFICERS

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WILLIAM G. GUY, *President-Elect*
FOLEY F. SMITH, *Secretary-Treasurer*
WILLIAM B. WARTMAN, JR., *Assistant Secretary*

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BYRON N. COOPER (1958)
WILLIAM HINTON (1959)
MRS. B. G. HEATWOLE (1960)
THOMAS E. GILMER (1961)
LYNN D. ABBOTT, JR.
JOHN C. FORBES, JR.
ROBERT T. BRUMFIELD
CHARLES F. LANE

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IRVING G. FOSTER (1958)
WALTER S. FLORY, JR. (1959)

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WILLIAM G. GUY, ROGER DUDLEY; *Public Information.*
MISS JEAN PUGH; *Junior Academy Exhibits.*
ALFRED R. ARMSTRONG; *Commercial Exhibits.*
J. T. BALDWIN, JR., JOHN L. MCHUGH, KENNETH A. WAGNER; *Field Trips.*

HOSTS TO MEETING

THE COLLEGE OF WILLIAM AND MARY IN VIRGINIA
THE COLLEGE OF WILLIAM AND MARY, NORFOLK DIVISION

OFFICERS OF THE VIRGINIA ACADEMY OF SCIENCE FOR 1957-58

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John C. Forbes, *President-Elect*
Paul M. Patterson, *Secretary*
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Walter S. Flory (1959)
Edward S. Harlow (1960)
Lynn D. Abbott, Jr.
Robert T. Brumfield
Charles F. Lane

PRESIDENT'S ADVISORY COMMITTEE
(Elected by Sections)

OFFICERS OF SECTION FOR 1957-58

Agricultural Sciences: James W. Midyette, Jr.; Chairman; Allen H. Allison, Vice-Chairman; S. S. Obenshain, Secretary; Carl W. Allen, Section Editor (1960)

Astronomy, Mathematics, and Physics: E. R. Dyer, Jr., Chairman; Jackson J. Taylor, Secretary; Irving G. Foster, Section Editor (1960)

Bacteriology (through December 31, 1957): Wesley Volk, President; Mrs. Barbara H. Caminita, Vice-President; Miles E. Hench, Secretary; P. Arne Hansen, Section Editor.

Bacteriology (beginning January 1, 1958): Mrs. Barbara H. Caminita, President; Miles E. Hench, Vice-President; Quentin N. Myrvik, Secretary-Treasurer, P. Arne Hansen, Section Editor

Biology: William J. Hargis, Jr., Chairman; B. L. Hanna, Secretary; Walter S. Flory, Jr., Section Editor (1962)

Chemistry: J. C. Holmes, Chairman; F. A. Vingiello, Secretary; Merle A. Kise, Section Editor

Education: Evan F. Pattishall, Jr., Chairman; Charles Turner, Secretary; James B. Patton, Section Editor

Engineering: Otis L. Updike, Jr., Chairman; Arthur C. Bruce, Secretary; Robert M. Hubbard, Section Editor

Geology: R. V. Dietrich, Chairman; J. T. Hack, Vice-Chairman; R. S. Mitchell, Secretary; W. D. Lowry, Section Editor (1958)

Medical Sciences: Cornelia Hoch-Ligeti, Chairman; Robert H. Bronson, Secretary; W. Parker Anslow, Section Editor (1961)

Psychology: Noble R. McEwen, President; Penelope Lewis, Secretary-Treasurer; William E. Harris, Executive Committeeman; John K. Bare, Section Editor

Science Teachers: Mrs. Vera Remsberg, Chairman; Mae Jennings, Chairman-Elect; A. B. Niemeyer, Jr., Secretary; Caroline Gambrill, Section Editor (1959)

Statistics: N. L. Enrick, Chairman; John W. Griswold, Vice-Chairman; R. A. Bradley, Secretary; Clyde Y. Kramer, Section Editor

COMMITTEES APPOINTED BY PRESIDENT GUY

Officers of the Academy will be ex-officio members of all committees.

LONG RANGE PLANNING

Lynn D. Abbott, Jr., *Chairman*

Alfred R. Armstrong
Lloyd C. Bird
William P. Boyer
Robert T. Brumfield
James W. Cole, Jr.
R. W. Engel
Allan T. Gwathmey
Edward S. Harlow
Ladley Husted
George W. Jeffers
Henry Leidheiser
Schuyler Miller
Sidney Negus
*Marcellus H. Stow

RESEARCH

Robert T. Brumfield, *Chairman* (1958)

R. A. Bradley (1959)
Chalmers L. Gemmill (1960)
Jackson J. Taylor (1961)
Henry Leidheiser (1962)

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*Deceased

FINANCE AND ENDOWMENT

Guy W. Horsley, *Chairman*

Lloyd C. Bird, Edwin Cox, Allan T. Gwathmey, Boyd Harshbarger, Sidney S. Negus, Charles T. O'Neill, Robert F. Smart, R. B. Smith

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W. Schuyler Miller, *Chairman*

J. C. Holmes, *Co-Chairman*

VIRGINIA FLORA

A. B. Massey, *Chairman*

Lena Artz, Walter S. Flory, Jr., Ruskin Freer, Ivey F. Lewis, Paul M. Patterson

JUNIOR ACADEMY OF SCIENCE

Mrs. B. G. Heatwole, *Chairman*

Richard Canham, E. R. Dyer, Susie V. Floyd, E. Sherman Grable, Beatrice Harrington, J. C. Holmes, Franklin D. Kizer, Reuben R. McDaniel, W. Schuyler Miller, Sidney S. Negus, H. Felix Sanders, Ashton Rudd

RESOLUTIONS

Zoe Black, *Chairman*

Nolan E. Rice, Marcellus Stow

NOMINATING

Irving G. Foster, *Chairman*

Walter S. Flory, Edward S. Harlow

PLACE OF MEETING

B. F. D. Runk, *Chairman*

Irving G. Foster, Andrew L. Ingles

JAMESTOWN FESTIVAL

*Marcellus H. Stow, *Chairman*
Robert T. Brumfield — Horton H. Hobbs

AWARDS

H. R. Hanmer, *Chairman*

Sidney S. Negus — Paul M. Patterson

MEMBERSHIP

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J. Francis Allen	Imogene B. Claiborne	Kenneth R. Lawless
G. Preston Burns	Catherine E. Corcoran	Henry Leidheiser
Thomas H. Christie	Dorothy D. Daughtrey	Willard A. VanEngel

SCHOLARSHIP

Sidney S. Negus, *Chairman*

Jesse W. Beams	H. R. Hanmer	W. T. Sanger
Lloyd C. Bird	Boyd Harshbarger	Marcellus H. Stow
Edwin Cox	Ivey F. Lewis	John W. Whittemore

CONSERVATION

Alfred L. Wingo, *Chairman*

A. H. Anderson	H. S. Mosby	Charles E. Packard
R. S. Bailey	George P. P. Mullin	E. E. Rodger
T. V. Downing	E. W. Mundie	D. S. Wallace
George W. Jeffers		I. D. Wilson

JAMES RIVER PROJECT

*Marcellus H. Stow, *Chairman*

Ivey F. Lewis	I. D. Wilson	Charles T. O'Neill
A. B. Massey		Foley F. Smith

To assist the State Board of Education in improving the Teaching of Science and relieving the Shortage of Scientists and Engineers.

E. D. Crittenden, *Chairman*

James W. Cole, Jr.	Irving G. Foster	Sidney S. Negus
R. A. Bradley	Edward S. Harlow	W. T. Sanger
Edwin Cox	Fred R. Millhiser	Robert F. Smart

*Deceased

BUSINESS MEMBERSHIPS

Guy W. Horsley, *Chairman*

Allan T. Gwathmey — Rupert Hanmer — Edwin Cox
Lloyd C. Bird — R. Blackwell Smith

HISTORY OF SCIENCE IN VIRGINIA

Irving G. Foster, *Chairman*

TRUSTEES

Lloyd C. Bird, *Chairman*

Rupert Hanmer — Charles T. O'Neill

LOCAL COMMITTEE ON ARRANGEMENTS (1958)

Boyd Harshbarger (Virginia Polytechnic Institute), General Chairman
David Rosbash (Veterans Administration Hospital), Housing
Paul M. Patterson (Hollins College), Meeting Rooms and Equipment
Ashley Robey (Roanoke College), Junior Academy Exhibits
H. L. Holloway (Roanoke College,) Registration
R. E. Garrett (Hollins College), Public Information
N. F. Murphy (Virginia Polytechnic Institute), Commercial Exhibits
P. R. Thomson (General Electric Company), Industrial Tours
Mrs. Ruth B. Painter (Roanoke), Entertainment for Ladies
Dorothy D. Montgomery, (WSLS-TV), Entertainment for Ladies
Mrs. Athena Burton (Roanoke College), Entertainment for Ladies
G. V. Downing, (Roanoke), Entertainment for Ladies

JEFFERSON MEDAL WINNERS

RECIPIENTS OF THE JEFFERSON GOLD MEDAL[1]

Alfred Chanutin	1936
William B. Porter	1937
H. M. Phillips	1938
G. M. Shear and H. D. Ussery	1939

RECIPIENTS OF THE JEFFERSON PRIZE[2]

L. G. Overholzer and John H. Yoe	1940
Allan T. Gwathmey	1941
R. N. Jefferson	1942
W. H. Hough	1943
Clinton B. Cosby	1944

RECIPIENTS OF J. SHELTON HORSLEY RESEARCH AWARDS

Carl C. Speidel	1927
John H. Yoe	1928
J. C. Street	1929
H. E. Jordan	———
Carl C. Speidel	1930
E. C. Stevenson	1931
James H. Smith	1932
S. A. Wingard	1933
E. P. Johnson	1934
Margaret Hess	1935
Alfred Chanutin	1936
R. G. Henderson	1937
S. G. Bedell	1938
M. J. Murray	———
F. F. Cleveland	1939
Walton C. Gregory	1940
Charles Ray	1941
No Award	1942
J. B. Meyer	1943
J. H. Taylor	1944
No Award	1945
Boyd Harshbarger and D. B. DeLury (separate papers)	1946

[1] The winning papers in this competition were entered against those of the North Carolina, South Carolina, Georgia, and Florida Academies of Science. It was discontinued in 1940.

[2] The winning authors had the choice of the Jefferson Prize or the Academy Prize during this period. The name of the Academy Prize was changed to the J. Shelton Horsley Award and the Jefferson Prize discontinued in 1944.

No Award	1947
Henry Leidheiser, Jr.	1948
Walter S. Flory, Jr.	1949
Erling S. Hegre	1950
David B. Duncan	1951
D. R. H. Gourley	1952
Stephen Berko	———
Frank L. Hereford	1953
Lynn D. Abbott, Jr. and Mary J. Dodson	1954
Albert W. Lutz	1955
M. C. K. Tweedie	1956
R. A. Bradley	1957
Walter H. Lewis	———

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General Program Of The 35th Annual Meeting 1957

All meetings will be held at the Hotel Chamberlin, Old Point Comfort, Virginia

WEDNESDAY, MAY 8

5:00 P.M. to 10:00 P.M.—Registration for Junior Academy Members and Participants in the Science Talent Search. Lobby.

5:00 P.M. to 10:00 P.M.—Arrangement of Exhibits. Sun Porch.

THURSDAY, MAY 9

8:00 A.M. to 10:00 P.M.—Registration. Lobby.
(Junior Academy members register and sign up for Jamestown tour before 10:00 *A.M.)*

9:00 A.M. to 9:30 A.M.—Meeting of Science Exhibit Judges. John Smith Room.
Meeting of Science Talent Search Judges. Chesapeake Room.

9:30 A.M. to 10:00 A.M.—Meeting of Chairmen, Exhibitors, and Science Talent Search Participants. Virginia Room.

10:00 A.M. to 12:00 P.M.; and 1:00 P.M. to 3:00 P.M.—Finalists of Talent Search meet with Chairmen and Interviewers. Parlors A, B, C, D, E, F.

10:00 A.M. to 12:00 P.M.; and 1:00 P.M. to 3:00 P.M.—Judging of Science Exhibit Contest. Sun Porch.

2:00 P.M.—Meeting of the Council of the Academy. Chesapeake Room.

3:00 P.M. to 10:00 P.M.—Junior Academy tour of Jamestown.

4:00 P.M.—Meeting of Section Officers. John Smith Room.

4:30 P.M.—Meeting of Section Editors. Chesapeake Room.

8:00 P.M.—Academy Conference. Virginia Room.

FRIDAY, MAY 10

8:30 A.M. to 10:00 P.M.—Registration. Lobby.

9:00 A.M.—Section Meetings. See the detailed sections programs for time schedule of papers.

Agricultural Sciences–Coffee Shop
Astronomy, Mathematics and Physics–Virginia Room
Bacteriology–Chamberlin Club TV Room
Biology–Roof Garden
Chemistry–John Smith Room and Chesapeake Room
Education–Parlor A
Engineering–Parlor B
Geology–Parlor C.
Medical Sciences–Chamberlin Club
Psychology–Parlor D and Parlor E.
Science Teachers–Parlor F
Statistics–Parlor G

12:00 Noon to 2:00 P.M.–Virginia Junior Academy of Science Assembly. Virginia Room. (See Program of Junior Academy.)

2:00 P.M. to 5:00 P.M.–Section Meetings.

3:00 P.M. to 4:30 P.M.–Tea and reception for visiting ladies given by the College Woman's Club of the College of William and Mary. Barrett Hall, East Living Room, Williamsburg campus.

8:00 P.M.–Virginia Academy of Science Assembly. Roof Garden.
Business Meeting: Election of Officers.
Presentation of the J. Shelton Horsley Research Award.
Guest Speaker: Willard F. Libby, U. S. Atomic Energy Commission, Washington, D. C.

Subject: "Atomic Energy Commission Policy and Methods"
The general public is invited to attend.

SATURDAY, MAY 11

The Section of Geology will hold a field trip to the Jamestown Island on Saturday, May 11. Leaders will be Mr. John L. Cotter, *Archeologist of the Colonial National Historical Park*, and *Dr. John T. Hack of the U. S. G. S.*

The program will include an archeological and geological tour of the island, a tour of the museum, and an illustrated lecture on the archeological excavations of the Island.

9:00 A.M.–Section Meetings.

10:00 A.M.–Meeting of the Council of the Academy.
Chesapeake Room or Parlor A (to be announced at the Thursday meeting of the Council).

TABULATION OF REGISTRATION

Section	Memb.	Non-Memb.	Total
1. Agricultural Sciences	19	14	33
2. Astronomy, Mathematics, & Physics	40	31	71
3. Bacteriology	12	8	20
4. Biology	68	19	87
5. Chemistry	58	30	88
6. Education	6	2	8
7. Engineering	6	8	14
8. Geology	16	9	25
9. Medical Sciences	19	7	26
10. Psychology	34	11	45
11. Science Teachers	16	5	21
12. Statistics	9	6	15
No Section Preference	29	27	56
Totals	332	177	509
Total Registration of the Junior Academy			320
Total Registration 1957 Meeting			829

MINUTES OF THE MEETING OF THE COUNCIL
OLD POINT COMFORT, MAY 9, 1957

The meeting was held at the Chamberlin Hotel, Old Point Comfort, Virginia. The President called the meeting to order at 2:00 p.m. Those present were:

Edward S. Harlow
Foley F. Smith
William G. Guy
Robert T. Brumfield
Walter S. Flory, Jr.
Sidney S. Negus
William M. Hinton
Irving G. Foster
Mrs. B. G. Heatwole
William B. Wartman, Jr.
Stanley B. Williams.

The Secretary read the minutes of the last meeting which were approved as read.

Stanley Williams, chairman of the Local Arrangements Committee, gave a report for this committee. He reported that the College of William and Mary would be dinner hosts to the members of the Junior Academy members making the trip to Jamestown. The President expressed his appreciation to the Local Arrangements Committee for their excellent arrangements made for the meeting. He also requested that the Secretary write to Dr. Chandler, President of the College of William and Mary, and express the appreciation of the Academy for their hospitality to the members of the Junior Academy.

OLD BUSINESS

Present Status of the Seashore State Science Center Proposal

The President reviewed the present status of the proposal which is still under consideration by the Board of Conservation and Development. He reported that plans for himself, W. G. Guy and others to visit the presidents of the University of Virginia, William and Mary, and Virginia Polytechnic Institute to discuss the possible participation by these institutions in the program, has been unavoidably delayed.

Changes in the Constitution and By-laws of the Academy

The Assistant Secretary read the proposed changes in the Constitution and By-laws. These proposed changes provide for separation of the office of Secretary-Treasurer into two offices, so that the officers would be President, President-elect, Secretary, Treasurer and Assistant Secretary-Treasurer. These changes were unanimously approved by Council.

REPORTS OF COMMITTEES

LONG-RANGE PLANNING COMMITTEE

Survey of Virginia Science Talent Search: It was reported that no source of funds to finance the Survey of the Virginia Science Talent Search had been found.

The Dismal Swamp Project: It was reported that little progress on the Dismal Swamp Project had been made since the last report, but it was hoped that work on this project could be accelerated during the summer. The Long-Range Planning Committee was asked to make every effort to expedite the completion of this project by the fall Council meeting.

MEMBERSHIP COMMITTEE

The report of this committee showed that intensive efforts of this committee had resulted in increased membership in the Academy. It was the feeling of Council that this committee be expressly commended for its contribution to the Academy.

BUSINESS MEMBERSHIP COMMITTEE

It was reported that plans for intensive efforts to secure additional business memberships will include the dissemination of a recently drafted concise statement of Academy activities in the fields of training of scientists, research and publication of the JOURNAL and the James River Monograph.

RESEARCH COMMITTEE

A record, both in number and total amount, in research grants was made by the committee this year. Dr. Forbes and his committee were highly commended by Council for their work in this important phase of Academy activities.

JUNIOR ACADEMY OF SCIENCE

Mrs. Heatwole reported a record participation in the Science Days held this year. She told of extensive plans for publicizing, in the secondary schools, the activities of the Academy, especially those of the Junior Academy.

REPORT OF THE EDITOR OF THE JOURNAL

Dr. Brumfield reported that the cost of publishing the JOURNAL under the new contract – awarded to the low bidder – was approximately double that of the former contract. This has necessitated the use of a

portion of the accumulated surplus funds of the JOURNAL. He requested that Council act to provide additional operating funds for the JOURNAL. Council requested that Dr. Brumfield present an operating budget to the Finance Committee and this committee is requested by Council to recommend means for providing necessary funds for the JOURNAL.

COMMITTEE TO AUDIT TREASURER'S RECORDS

This committee reported that the Treasurer's records for 1956 appeared to be in order.

NEW BUSINESS

The President read a letter from Mr. F. A. Ernst, president of the Virginia State Chamber of Commerce, inviting the Academy to become a member of that organization. Council passed a motion that the President reply stating that although the Academy was in accord with the objectives of the Virginia State Chamber of Commerce, it would not be able to become a member.

The President read a letter from Dr. Kellner of the Virginia Resource-Use Education Council requesting that the Academy contribute toward the workshop program of this group. It was the feeling of Council that the Academy was unable to contribute to this program.

The President also read a letter from Dr. C. L. Baker of the History Committee of the American Association for the Advancement of Science requesting that the Virginia Academy of Science have a History of Science Committee. A motion was passed that the president of the Academy appoint a History of Science Committee and to inform Dr. Baker of the membership of this committee. This committee will develop the history of science in Virginia.

The President expressed his appreciation to Council for their cooperation and assistance.

Council passed a motion that E. S. Harlow be commended for his outstanding service to the Academy during the past year.

The meeting was adjourned at 4:00 p.m.

— WILLIAM B. WARTMAN, *Assistant Secretary*

MINUTES OF THE ACADEMY CONFERENCE
OLD POINT COMFORT, MAY 9, 1957

The Academy Conference was held in the Virginia Room of the Hotel Chamberlin of Old Point Comfort, a forum of more than forty members being present. The meeting was called to order at 8:15 P.M. by President Edward S. Harlow. After proper motion, the reading of the minutes of the last Academy Conference was dispensed with, as they were published in the Virginia Journal of Science.

The report of the Secretary-Treasurer was read, and after Stanley Williams, Chairman of the Local Committee on Arrangements, announced some changes in the meeting rooms and the program, the various standing committees reported for the year. These reports follow in the Proceedings of the Annual meeting of 1957.

In order to eliminate the expense of an annual audit, an experiment was tried this year in having an auditing committee study the books and accounts of the Treasurer and report to the Conference. This special committee reported at this time and declared that the records and accounts of the Treasurer were in good order.

The proposed changes in the Constitution and By-laws recommended and passed by the Council, providing for a separation of the offices of Secretary-Treasurer into two offices, were read by the Assistant Secretary, William B. Wartman, Jr., and were unanimously passed by the Conference. It was noted that the revised corrected Constitution and By-laws would be mimeographed and sent to officers, members of the Council, and Section officers.

There being no further business, the meeting adjourned at 10:40 P.M.

Foley F. Smith, *Secretary*.

MINUTES OF THE ACADEMY MEETING
OLD POINT COMFORT, MAY 10, 1957

The meeting was called to order by President Edward S. Harlow at 8:10 P.M., in the Virginia Room of the Hotel Chamberlin, Old Point Comfort. President Harlow made a few remarks concerning the excellence of the meeting and complimented the planning of the Local Arrangements Committee, and noted at this time there were 500 seniors and 320 juniors registered, making it one of our largest meetings.

William Guy was recognized, representing Dr. Alvin Chandler, President of the College of William and Mary, host to the meeting, and welcomed the Virginia Academy to the Eastern area of the State. Dr. Guy also expressed the regrets of Dr. Chandler that he was unable to be present at the Academy meeting.

A report of the Nominating Committee was made and their slate was unanimously accepted with the following officers being elected.

William G. Guy, College of William and Mary, President.

John C. Forbes, Medical College of Virginia, President-Elect.

Paul M. Patterson, Hollins College, Secretary.

Foley F. Smith, A.B.C. Board, Treasurer.

William B. Wartman, Jr., American Tobacco Company Research Laboratory, Assistant Secretary-Treasurer.

Horton H. Hobbs, Jr., University of Virginia, was elected to the Council for a term of five years.

Dr. Raymond Taylor, Assistant Administrative Secretary of the AAAS was recognized and extended greetings to the Virginia Academy from the American Association for the Advancement of Science on the occasion of its 35th annual meeting.

John C. Forbes reported for the Research Committee, and announced that because of the equal excellency of two papers submitted for the J. Shelton Horsley award, the award would be divided this year. The recipients of the two prizes were:

(1) D. E. Schumann and R. A. Bradley, Virginia Agricultural Experiment Station, V.P.I., for a paper on "The Comparison of the Sensitivities of Similar Experiments."

(2) Walter H. Lewis, Blandy Experimental Farm, University of Virginia, for a paper on "A Biosystematic Study of *Rosa Acicularis*."

The Teacher Sponsor scholarship awards were made to:

Miss Gilliam Phenix (College of William and Mary scholarship) and O. P. Sadler, Buckingham Central High School, (University of Virginia scholarship).

The report of the Resolutions Committee was made by I. G. Foster, and was accepted. (These Resolutions appear under Committee Reports).

The report of the Place of Meeting Committee recommended that the 1958 meeting of the Academy be held at the Hotel Roanoke, Roanoke, Virginia. It was further recommended that an invitation to the Academy for its meeting for 1959 by the University of Virginia, be accepted. The report of the committee was unanimously accepted.

The business session adjourned, and the guest speaker of the evening, Dr. Willard F. Libby, of the U. S. Atomic Energy Commission, Washington, D. C., was introduced by President Harlow. He gave a very interesting address on "Atomic Energy Commission Policy and Methods." Afterward the address, the meeting adjourned.

Foley F. Smith, *Secretary*

MINUTES OF THE VIRGINIA ACADEMY OF SCIENCE

COUNCIL MEETING

OLD POINT COMFORT, MAY 11, 1957

The Council of the Virginia Academy of Science met at the Chamberlin Hotel, Old Point Comfort, May 11, 1957. The president called the meeting to order at 10:05 a.m. Those present were:

William G. Guy	Mrs. B. G. Heatwole
Edward S. Harlow	Allan T. Gwathmey
Walter S. Flory	Lynn D. Abbott, Jr.
John C. Forbes	Foley F. Smith
William M. Hinton	William B. Wartman, Jr.

The following items were discussed and action taken as noted:

OLD BUSINESS

The Seashore State Science Center Proposal: The president reported that he, E. S. Harlow and perhaps others will visit the presidents of the University of Virginia, Virginia Polytechnic Institute, and the College of William and Mary and discuss the possible participation of these institutions in the proposed Science Center.

Funds to Finance the Survey of the Virginia Science Talent Search: The Long-Range Planning Committee was requested by the president to investigate possible sources for such funds. Council members were requested to forward any suggestions for sources to Dr. Abbott.

Business Membership Committee: The president reported that he will reappoint this committee who will, by letter or personal contract, seek to increase the Business Memberships in the Academy.

History of Science Committee: The president reported that he will appoint a History of Science Committee to develop the history of science in Virginia.

NEW BUSINESS

Public Information Committee: After considerable discussion on the subject of publicizing the Academy and its activities, a motion was passed that the president, after consultation with Dr. Negus, appoint a Public Information Committee with Dr. Sidney S. Negus as chairman, and including the secretary in its membership.

Funds for the Junior Academy Activities: Mrs. Heatwole requested that Council provide additional funds for the Junior Academy activities. Mrs. Heatwole was requested to submit a budget covering Junior Academy activities to the Finance Committee prior to its fall meeting so that the Finance Committee would be able to include necessary Junior Academy funds in the budget to be presented at the fall Council meeting.

Dr. Sidney S. Negus: A motion was passed that Dr. Sidney S. Negus be commended for his outstanding contribution to the Academy while serving as a member of the Council.

Mr. Foley F. Smith: Council passed a motion that the Editor of the Journal publish in the Journal an expression of appreciation to Foley F. Smith for his services as Secretary-Treasurer of the Academy.

Dr. Bruce D. Reynolds: Council passed a motion that a statement, formally recognizing the many years of services to the Academy of the late Dr. Bruce D. Reynolds, be published in a forthcoming issue of the Journal. Dr. Walter S. Flory will prepare the statement for publication.

Other Business: Mr. E. S. Harlow reported that R. M. Irby had resigned as Advertising Manager of the Journal.

Mrs. Heatwole, as chairman of the Junior Academy Committee, expressed appreciation to E. S. Harlow for his work on behalf of the Junior Academy.

The meeting was adjourned at 11:25 a.m.

William B. Wartman, Jr.
Assistant Secretary-Treasurer

REPORT OF THE SECRETARY-TREASURER

The thirty-fifth meeting of the Virginia Academy of Science appears to be one of the largest in the history of the Academy, if not the largest. Again, the Junior Academy exhibits are outstanding, and has the largest total number of exhibits both individually and class exhibits than at any meeting so far.

This year, as an experiment, it was decided to appoint an Auditing Committee to examine the books and records of the Secretary-Treasurer, instead of paying for the expense of a more complete audit by a C.P.A. The report of this Auditing Committee, and of the Finance Committee relative to the budget follow along with the reports of the standing committees.

American Association for the Advancement of Science Meeting – The Academy was represented at two Council meetings of the AAAS in New York City, on December 27 and 30 ,1956. The Council elected Dr. Wallace R. Brode as President-Elect of the Association. Dr. Brode is Associate Director of the National Bureau of Standards, Washington, D. C. Laurence H. Snyder became President of the Association, and Dr. Paul B. Sears, the Retiring President. Paul E. Klopsteg, Emeritus Professor of Engineering, Northwestern University, and Alan T. Waterman, Director of the National Science Foundation, were elected to the Board of Directors.

REPORT OF THE LONG-RANGE PLANNING COMMITTEE

The main efforts of the Long Range Planning Committee during the year 1956-1957 have been concerned with the question of the utilization of the Seashore State Park referred to the Committee by the Council at its meeting on May 12, 1956. At that time it was recommended that a subcommittee be set up by the Long Range Planning Committee to consider the matter of utilization of the Seashore State Park. This subcommittee was established in July, 1956, under the able chairmanship of Dr. Henry Leidheiser, Jr., with Marcellus Stow, J. T. Baldwin, I. G. Foster and the late Bruce D. Reynolds serving actively. Dr. Armstrong represented Dr. Guy, and Dr. Abbott attended for Dr. Negus. This subcommittee met several times during the summer of 1956 and prepared recommendations which were accepted by the Committee and by Council in Charlottesville, October 7, 1956. Following this, members of the Long Range Planning Committee continued to work with Mr. Harlow on this project during the year, and met several times with the Director of the Department of Conservation. The results of these meetings and the present status of our formal proposal to the Department of Conservation have been presented to the Council by Mr. Harlow.

At a meeting of the Committee in Charlottesville, October 7, 1956, Mrs. Heatwole's proposal of September 19, 1956, for a grant from the National Science Foundation for a study of the effectiveness of the Virginia State Science Talent Searches was approved and sent to Council. Approved by Council, the proposal was submitted to the National Science Foundation by Mr. Harlow, Drs. Negus and Abbott during a meeting in Washington on October 12, 1956. The Academy was informed on January 25, 1957, that the National Science Foundation would be unable to support this proposal, and the Survey has not yet found financial support.

No progress has been made during the past year on the Dismal Swamp Project. Dr. J. T. Baldwin reports he hopes to find some time during the summer to devote to it.

The chairman wishes to take this opportunity to thank all members of the Committee for their enthusiastic cooperation.

Lynn D. Abbott, Jr., *Chairman*

REPORT OF RESEARCH COMMITTEE

GRANTS: During the period May 1, 1956, to May 1, 1957, the following grants were made:

J. D. Burke and W. S. Woolcott, Department of Biology, University of Richmond, for a study on blood oxygen capacity in fish and relationship to environment factors. $ 250.00

W. L. Burger, Department of Biology, College of William and Mary for a continuation of his study on the ecology and taxonomy of reptiles and amphibians with particular emphasis on (1) A taxonomic and ecological study of the Rough Green Snake and (2) Distributional studies of the turtle and frogs of Eastern Virginia. 85.00

Mitchell A. Byrd, Department of Biology, College of William and Mary for a study on ***Plasmodium berghei.*** 125.00

Harry L. Holloway, Department of Biology, Roanoke College for the purchase of animal cages to be used in a study on the life cycle of *Hydatigera lyncis*, a tapeworm of the bobcat which passes its cysticerous stage in the wood rat. 110.00

Roscoe D. Hughes, Department of Biology, Medical College of Virginia for the purchase of testing anti-sera, films, etc. used in an investigation of the dento-facial region in growing twins and their families. 200.00

Roger Rageot, Curator, Natural History, Norfolk Museum, for a continuation of his study on the fauna of the Dismal Swamp. 125.00

Nolan E. Rice, Department of Biology, University of Richmond, for an investigation on the ecology and physiology of the fresh-water medusa, *Craspedacusta sowerbii.* 125.00

Robert D. Ross, Department of Biology, Virginia Polytechnic Institute for the purchase of alcohol to be used in permanently preserving fish collected in cooperation with the Commission of Game and Inland Fisheries. This material is a part of the Research Museum of the College. 125.00

Grover C. Smart, Miller School of Biology, University of Virginia for travel expense incurred in connection with a study of the life history of the crayfish, *Cambarus longulus longulus.* 125.00

Jesse C. Thompson, Jr., Department of Biology, Hollins College, for the purchase of an ortho-Illuminator to be used in a morphological study of the ciliated protozoan fauna of tree borne lichens and mosses. 173.00

John H. Wise, Department of Chemistry, Washington and Lee University, for the purchase of a spectrophotometer to be used in research work on reactions of nitryl chloride, etc.	340.00
Total	1,783.50
J. Shelton Horsley Research Prize for 1957	150.00
Total expenditures for May 1, 1956, to May 1, 1957	$1,933.50

Since the requests for grants were considerably in excess of the amount of money available for distribution, the Academy Council transferred $800.00 of previously unexpended research funds to the Committee, thus enabling it to grant in all cases at least a part of the amount requested. We are confident that these grants-in-aid, small as they are, are of inestimable value to the cause of science in Virginia. They have in many cases enabled well trained scientific personnel to carry on research projects which might not have been possible otherwise on account of the limited research funds available to them. We are all aware of the fact that many of the scientific personnel within the State are so busy with teaching or other duties that they have time for research only during the vacation period. On account of this these individuals find it difficult to obtain support from large foundations. The Virginia Academy of Science can make no greater contribution to the welfare of the State and the Nation than by doing all in its power to support the research interests of these individuals.

J. C. Forbes, *Chairman*

REPORT OF THE AUDITING COMMITTEE

The committee appointed by President Harlow as a special committee on March 6, 1957, has followed his request to go over the Secretary-Treasurer's books in order to be prepared to say whether or not the books are in order.

The committee has examined the general checking account of the Secretary-Treasurer, V.A.S. as represented by check stubs in the Treasurer's checkbook and monthly statements of the First and Merchants National Bank of Richmond and find as follows:

Cash on deposit in Bank as of December 31, 1955	$ 5137.87
Deposits during year December 31, 1955-December 31, 1956 (as shown in Treasurer's checkbook	6217.10
	11254.97
Expenditures during year December 31, 1955-December 31, 1956 (as shown in Treasurer's checkbook)	6113.31
Balance	5241.66
Bank statements show: Cash on deposit as of December 31, 1956	5250.31

The Academy, therefore, has on deposit as of December 31, 1956, a sum of $8.65 in *excess* of that shown in the Treasurer's books.

We have examined the Research Checking Account and find it to be in complete accord with the statement of the First and Merchants National Bank of Richmond as of December 31, 1956.

We have examined the Stock Certificates held in the personal deposit box of the Secretary-Treasurer and find 12 shares Food Fair Stores, Inc. No. 286; 11 shares Virginia Electric and Power Company, No. 11323. The income from the shares is added to the General Checking Account.

Also available for inspection were the Cash Receipt Book and the Cash Disbursement Book and the statement of the First and Merchants National Bank of Richmond on the condition of the Endowment Fund, income from which is credited to the Research Checking Account.

In the light of the above report we are prepared to say that the books of the Secretary-Treasurer, V.A.S. are in order.

William G. Guy, *Chairman*
Walter S. Flory, Jr.
Russell H. Rowlett, Jr.

REPORT OF THE RESOLUTIONS COMMITTEE

The Virginia Academy of Science expresses its appreciation for their contributions to the success of the 1957 annual meeting to the host institutions, the College of William and Mary and the College of William and Mary, Norfolk Division, to the Chamberlin Hotel, and to Stanley B. Williams and his local committee on arrangements.

For his six years as managing editor and editor of the Virginia Journal of Science, the Academy is indebted to Horton H. Hobbs. His contribution to the success of the Journal is of inestimable value.

The membership committee of the Academy merits sincere thanks for its outstanding work in recruiting new members. In particular, the unremitting efforts of Mrs. Geraldine M. Duncan in this work deserves recognition.

The Virginia Academy of Science has suffered a great loss in the recent death of Dr. Bruce D. Reynolds, Professor of Biology of the University of Virginia. Long active in the affairs of the Academy, he was ever willing to lend his talent and energy to the solution of its problems. His role in founding the Blandy Experimental Farm and the Mountain Lake Biological Station was of primary importance and they will remain as monuments to his influence in the scientific life of the Commonwealth of Virginia.

Finally, the Academy recognizes its loss through death of several members of long standing during the past year.

I. G. Foster, *Chairman.*

REPORT OF THE COMMITTEE ON THE VIRGINIA SCIENCE TALENT SEARCH

The twelfth Virginia Science Talent Search was conducted as usual in cooperation with the National Science Talent Search. Of the one hundred and seventy-four Virginia high school students who entered the search, seven received National Honorable Mention.

Our own reading committee considered all of the Virginia entries and selected the top forty-five as finalists to come before interviewing committees at the Old Point Comfort meeting of the Academy. The list of fifteen Winners chosen by the interviewers, and also the list of Honorable Mentions, will be attached to this report*. All cooperating colleges and universities already have received a list of the finalists. At the conclusion of this meeting they will be sent the lists of Winners and Honorable Mentions.

The director is grateful for the assistance of the following who serv-

ed on the reading committee:

Richard M. Irby, Jr.
Mary E. Kapp
Noble R. McEwen
E. Clifford Nelson
J. Doyle Smith
William E. Trout, Jr.

Thanks are also due to the judges who helped with the interviewing of the finalists:

Alfred R. Armstrong
Frank Boldridge
Jane Bell Gladding
Richard M. Irby, Jr.
Mary E. Kapp
J. L. McHugh
W. Allan Powell
J. Douglas Reid
Wade J. Temple

Special appreciation goes to Mr. William B. Wartman and the American Tobacco Company for taking care of a large part of the secretarial work.

W. Schuyler Miller, *Chairman.*

REPORT OF THE SCHOLARSHIP COMMITTEE

The functions of the Academy Scholarship Committee, composed of Messrs. Beams, Bird, Cox, Hanmer, Harshbarger, Ivey Lewis, Negus, Sanger, Stow, and Whittemore are primarily twofold.

1. To assist worthy students with aptitudes for scientific careers in securing financial aid to pursue their studies in the educational institutions of their choice.

2. To serve as counselors to students interested in scientific careers and to teachers of science, especially in the public and private high schools of Virginia.

The specific accomplishments of this committee during the past year are difficult to report. Scholarships in colleges have been obtained for several students and many have been advised about their future careers. Each case concerned is always an individual one. Quite a few science teachers have been informed about scholarships available for their outstanding students.

It is not yet well enough known by high school seniors and science teachers of the State that there is an Academy Scholarship Committee. During the second year of this new committee's existence, efforts will be made in various ways to be of more service to those needing counsel in matters having to do with scholarships.

Sidney S. Negus, *Chairman*

THE VIRGINIA JUNIOR ACADEMY OF SCIENCE COMMITTEE

The Virginia Junior Academy of Science had during 1956-57 an individual membership of 7438, representing clubs in both Junior and Senior High schools from every region of the State. Charters were issued to 29 new clubs.

The following activities were carried out during the year:

Mimeographed letters concerning activities were mailed three times during the year to all public and private high schools in the State.

The JUNIOR SCIENCE BULLETIN was issued two times during the year and mailed to every science teacher whose address could be obtained. The publication of the BULLETIN was made possible by a contribution of $200.00 by the American Tobacco Research Laboratory. The printing was done under the direction of Miss Susie V. Floyd.

Grants were made to assist in project work from research funds made available by the Philip Morris Co., Inc.

Summer scholarships of $200.00 each were again made available by the University of Virginia and the College of William and Mary to two outstanding Teacher-Sponsors.

Junior Science Days were sponsored by Virginia Polytechnic Institute, University of Richmond, College of William and Mary, University of Virginia, and Virginia Union University. Eighty-one schools, represented by 2261 students, participated in the Junior Science Days. Two hundred and ninety-one exhibits were displayed. From them, 79 exhibits were selected for display at the annual meeting.

ANNUAL MEETING

The annual meeting of the Junior Academy was held at the Hotel Chamberlin, Old Point Comfort, on May 9th and 10th. Sixty-one individual and nine club displays were exhibited. Over three hundred student delegates registered during the meeting and many other interested individuals visited the exhibit area. An outstanding panel of scientists judged the research exhibits and counselled the students on their research projects and on their preparation for scientific careers.

At the JUNIOR ACADEMY ASSEMBLY on May 10th, Dr. Willard F. Libby, Vice-Chairman of the Atomic Energy Commission, spoke briefly to the students, encouraging them to become discoverers and conquerors through research, study and understanding.

Dr.Allan T. Gwathmey, Professor of Chemistry at the University of Virginia, who is an international authority on metal crystals, was the guest speaker. His lecture on "The World of Crystals" was exceptionally dynamic and inspirational.

Awards for individual research projects were again made possible by a grant from the Philip Morris, Co., Inc. They were given to first, second and third place winners in each of four categories: Physics, Chemistry, Biological Sciences, and Miscellaneous Sciences.

Philip Morris Achievement Awards

BIOLOGY

1st–Transforming of Bacteria – Exhibitor – Wilfreta Gourdine – I. C. Norcum High School. – Sponsor – Mrs. M. A. Parham.

2nd–"Investigations Involving a Pancreas-Adrenal-Pituitary-Sulfhydrl Axis." – Washington-Lee High School – Exhibitor – Ralph Dougherty – Sponsor – Mr. E. M. North.

3rd–"The Culture of Chick Embryo Heart Tissue Outside the Organism." – William Fleming High School – Exhibitor–Jim Baird – Sponsor–Mrs. Ruth Painter.

HONORABLE MENTIONS

"Cerebral Development in Vertebrate Animals" – Jefferson Senior High School – Exhibitor–Bill Wallace – Sponsor–Mrs. Kay Sheppard.

"Some Effects of Ray Radiation" – Radford High School – Exhibitor–Tony Giesen – Sponsor–Miss Mae Jennings.

"Palentology of Lower York-James Peninsula" – Hampton High School – Exhibitor–Godfrey Smith – Sponsor–Mr. D. E. Rose.

CHEMISTRY

Two exhibitors tied for First. "Polymerization of Monomers." – Exhibitor–Joe Glema – Washington & Lee High School, Arlington, Va. – Sponsor–Edward North, and "Phosphorus as a Nutrient for Algae in Marine Waters" – Newport News High School – Sponsor–Mr. J. W. Mays – Exhibitor–Miss Page Smith.

Third Place – "Powder Metallurgy – Tungston Carbide" – Exhibitor – Larry Gilmer – Mount Vernon High School – Sponsor–Mr. R. H. Horn.

HONORABLE MENTIONS

"See Better Through Plastic." – Peabody High School, Petersburg, Va. – Exhibitor – Miss Yolanda Ridley – Sponsor–Mr. N. S. Gilliam.

"Chromotography" – Craddock High School – Exhibitor–Robert Copeland – Sponsor–Alan Mandell.

PHYSICS

Tie for First – "Electronics Photographic Negative Intensifier" – Exhibitor – Johnny Williams – Jefferson High School – Sponsor–Mr. Caldwell and "Coil Properties on Crystal Radio Reception" – Exhibitor – Tommy Yancy – Buckingham Central High School – Sponsor – Mr. O. P. Sadler

Third – "Experimental Wind Tunnels" – Exhibitor – Irwin Gladstone – Woodrow Wilson High School – Sponsor – Mrs. J. K. Fordham.

HONORABLE MENTIONS

"Wilson Cloud Chamber" – Exhibitor – Robert Miller – Radford High School – Sponsor–Miss Mae Jennings

"Ramjet Propulsion" – Exhibitor – William Todd – I. C. Norcum High School – Sponsor–Mr. John F. Bailey & Mrs. Parham.

"Principles of Stadia" – Exhibitor–Mary Brown – McLean High School – Sponsor–Miss Pilgrim.

"Astronomical Telescope" – Exhibitor–Charles Joyner – Bolling Junior High School.

"Maxwell-Boltzman Energy Distribution" – Exhibitor–David Lundquist – Newport News High School – Sponsor – Mr. J. W. Mays.

"Speech Memory Unit" – Exhibitor–Larry Adams – Falls Church High School – Sponsor–Mrs. Nell Shugrua.

"Electric-Arc Furnace" – Exhibitor–Frank Woolley – James Monroe High School – Sponsor–Mr. Robert Hodge.

MISCELLANEOUS

1. "Geological Survey of the New Market Creek Area" – Exhibitor – Vernon Rollins – Hampton High School – Sponsor–Dale E. Rose.
2. "Virginia Minerals and Rocks" – Exhibitor–Rudolph J. Bland, Jr. – Thomas Jefferson High School, Richmond – Sponsor–Miss Ellet
3. "Effect of Music on Study Habits" – Exhibitor–Carl Hacker – Newport News High School – Sponsor – Mr. J. W. Mays

HONORABLE MENTIONS

"Binary Mathematics" – Exhibitor–Denise Brooks – McLean High School – Sponsor–General Rumbaugh.

"Products of Indian Ingenuity" – Exhibitor–Irvin Catlett – Buckingham Central High School – Sponsor–Mr. O. P. Sadler

CLUB AWARDS

1st–Horizons Unlimited – Victoria Jr. Science Club – Victoria High School – Sponsor–Mrs. Jesse Turner

2nd–"Insects" – Newport News High School Science Club – Newport News High School – Sponsor – Mr. J. W. Mays.

3rd–An Investigation of the use of sequence in logical reasoning. – Huntington High School Science Club – Huntington High School – Sponsor – Miss Lillian Weaver.

E. C. L. Miller Award – to club having the most outstanding program of activities for the year. – Eagle Rock High School Science Club Eagle Rock, Virginia – Sponsor – W. W. Cash, Jr.

Major N. Catesby Jones Award – to individual who showed outstanding research ability. – Tommy Yancy, Buckingham Central High School.

Honorary Membership in AAAS – Wilfreta Gourdine, I. C. Norcum High School – Vernon Rollins, Hampton High School.

Honorary Memberships in VAS – John Towler – Halifax High School Mary Lou Myers, Eagle Rock High School.

Teacher Sponsor Scholarships – College of William and Mary – E. M. North, Washington & Lee High School, Arlington – Alternate –Miss Jane Gilliam, Phenix High School, Phenix.
University of Virginia – O. P. Sadler, Buckingham High School Alternate–Miss Mae Jennings, Radford High School.

The following awards were made in the Twelfth Virginia Science Talent Search:

WINNERS OF THE
TWELFTH VIRGINIA SCIENCE TALENT SEARCH
1956-57

Adelberger, Rexford Earle	Washington-Lee High School
*Bacon, Otis Blake	Warren County High School
*Charlton, Mary Virginia (Miss)	Buckingham Central High School
Chilton, Helen M. (Miss)	Washington-Lee High School
*Clema, Joseph Kotouc	Washington-Lee High School
*Fritz, Harold Geiger	Wakefield High School
Gillum, Gary Patrick	Mount Vernon High School Fairfax County, Virginia

Hagenbuch, John Randolph	Washington-Lee High School
Hinton, Albert Lucius	Booker T. Washington High School
*Lundquist, David Eugene	Newport News High School Newport News, Virginia
Schulthesis, William B.	Washington-Lee High School
*Smith, Kathryn Page (Miss)	Newport News High School
*Traylor, Rock Roberson	John Marshall High School
Veasey, William Maury	Andrew Lewis High School
Williams, John Garland	Jefferson Senior High School

HONORABLE MENTION IN THE TWELFTH VIRGINIA SCIENCE TALENT SEARCH

Allen, Marian Janet (Miss)	Check High School, Check, Virginia
Auton, David Lee	Washington-Lee High School
Baber, Albert Thornhill	Buckingham Central High Buckingham, Virginia
Bradshaw, Jerry Orem	Tazewell High School
Brain, Willard	Falls Church High School
Brunton, Nancy Ann (Miss)	Lane High School
Burton, Claudia Elizabeth (Miss)	Washington-Lee High School
Cahoon, Betty Frances Louise (Miss)	Cradock High School
Dougherty, Ralph C.	Washington-Lee High School
Harold, Douglas Walker	Washington-Lee High School
Haupt, Walter Preston	Jefferson Senior High School
Hodder, Robert Edwin	Hermitage High School
Hooks, Kenneth Robert	Washington-Lee High School
Hudson, John Henry	Mount Vernon High School
Johnson, David Copeland	Osbourn High School
Lyons, Barbara Jean (Miss)	Castlewood High School
Manly, Charles Lynhaven	Washington-Lee High School
Noel, Thomas Howard	Farmville High School
Othmer, Siegfried	Manchester High School
Phipps, Donald Lee, Jr.	William Fleming High School
Richardson, Claude Artice	Huntington High School
Riegel, Kurt	Lexington High School
Roland, Flora Ann (Miss)	Cradock High School

*Honorable Mention in the National Science Talent Search.

Sanford, Frederick Earl	King George High School King George, Virginia
Scoville, James Griffin	Washington-Lee High School
Stephens, Franklin Marshall	Washington-Lee High School
Towler, John Cotten	Halifax County High School South Boston, Virginia
Walker, Jefferson Hiden, Jr.	Warwick High School
Yens, David E.	Mount Vernon High School Alexandria, Virginia
Young, John Arthur	Washington-Lee High School

REPORT OF JAMES RIVER PROJECT COMMITTEE

An appropriate jacket for the James River Monograph has been designed by Elmo Jones of Richmond and printed by the Dietz Press. Copies of the Monograph, with jacket, are now on sale at the Information Center of the Jamestown Festival, at Cokesbury's Book Shop, Thalhimers, and Miller and Rhoads.

Financial statements as of April 30, 1957, is as follows:

Total copies distributed as of April 30, 1956	546
Balance on deposit, Peoples Nat. Bank., Lex., Va., as of April 30, 1956	$ 183.90
Complimentary copies distributed between May 1, 1956, and Apr. 30, 1957	6
Copies sold at $6.00 between May 1, 1956 and April 30, 1957 (7)	$ 42.00
Copies on consignment for Jamestown Festival	105
Total copies distributed between May 1, 1956 and April 30, 1957	118
Deposited in Peoples Nat. Bank between May 1, 1956 and Apr. 30, 1957	$ 42.00
Expenditures between May 1, 1956, and April 30, 1957	$ 78.10
Account in Trust Dept., First & Merch. Nat. Bank, Richmond, Va. (exclusive of interest)	$1600.00
Total to credit of James River Project as of April 30, 1957	$1678.10
Total copies of Monograph distributed between May 11, 1950 and April 30, 1957	664

Marcellus H. Stow, *Chairman*

REPORT OF THE COMMITTEE ON CONSERVATION

Through their work as teachers or supervisors in a variety of fields the members of your Conservation Committee influenced thousands of people during the past year in every phase of conservation. The member of the Committee who works with vocational agriculture indicated that 23,588 youths and adults were enrolled last year in organized classes in that field. It required three single-spaced typewritten pages to set forth a digest of the conservation acitvities engaged in by those groups.

Conservation essay contests have been promoted by members of your Committee. In addition to teaching, some of your Committee members have written newspaper and magazine articles, made a number of speeches both inside and outside of the laboratory or classroom, promoted the use of conservation materials, and given a variety of demonstrations. The member of the Committee who works in marine biology prepared and presented forty television programs, as a part of his promotional work. The water resources engineer member of your Committee has been conducting a research project on a small watershed in the Piedmont. One of the forester members of the Committee is involved in an interesting research project in silviculture that deals with the runoff from logging roads.

Most of the members of your Committee are also members of the Virginia Resource-Use Education Council. This Council has published a bulletin entitled, *A Look at Virginia's Natural Resources.* Last summer the Council promoted and carried through to completion at V.P.I. a very successful resource-use workshop for teachers. The Council has plans for conducting resource-use workshops for teachers at V.P.I. and the College of William and Mary during the summer, 1957.

Doubtlessly, the Academy will be interested to learn that the Commonwealth Fund is contributing $3,000 for the current year and it has agreed to contribute a like amount for the years 1958 and 1959, to be used as scholarships for teachers who attend resource-use workshops. Your Committee feels that it would be proper for the Academy to pass an appropriate resolution expressing its appreciation and commending Mr. Monroe Bush for the wisdom of the contribution.

In the judgement of your Committee, there are two matters to which the attention of the Academy should be called. (1) The efforts of the Virginia Resource-Use Education Council, a voluntary organization, which culminated in a resource-use workshop for teachers last summer and plans for two such workshops this summer represent a large undertaking. Planning and raising funds for these workshops require much effort, thought, time, and preseverance on the part of many individuals. Your Committee believes that the Academy should commend, endorse, and support the efforts of this Council in every way possible. (2) According to information that has come to your Committee, the cooperative enter-

prise that has been carried on for years by the State Division of Water Resources and the U. S. Geological Survey will be terminated June 30, 1957. Apparently, this termination of cooperative efforts by these two agencies will be unfortunate because some of the work will be curtailed and the two parallel organizations will continue with partial programs.

Alfred L. Wingo, *Chairman.*

REPORT OF COMMITTEE ON VIRGINIA FLORA

There is little opportunity for group activity by the Committee on account of the fact that its members are scattered throughout the State. Individuals of the Committee and other botanists in the State have been active in studies relative to the State Flora or, through lectures and demonstrations, have promoted a better appreciation of native plants and vegetation. Dr. Patterson has continued active studies of the mosses and liverworts of Virginia. A paper is in press reporting new records of Hepatics in Virginia. Other papers on the mosses have been issued. Mr. W. H. Lewis, working with Dr. Flory, has submitted a thesis reporting biosystematic study of the genus *Rosa*. This considers the species of *Rosa* east of the Rocky Mountains; hence, gives valuable information relative to species native to this State. Dr. J. T. Baldwin reports biosystematic studies of certain native plants. At V.P.I. an illustrated bulletin on the Legumes of Virginia has been issued. This considers native and introduced species. A short report is in press relative to the presence of goat grass, *Aegilops cylindrica*, a new species for Virginia. A manuscript on the grasses of Virginia is in preparation for publication in early 1958. Having been granted untrained assistance, the State Herbarium at V.P.I. is being put into much better condition. Several thousand additional specimens have been mounted and filed. Many specimens from over the State have been received for identification. These are mostly plants of economic interest. Several hundred herbarium specimens have been received and filed in the herbarium.

A. B. Massey, *Chairman*

REPORT OF THE EDUCATION COMMITTEE

The Education Committee is the outgrowth of the Advisory Panel on Education in the Sciences which was so ably headed by Professor James Cole, Jr., in 1955-1956. Following the annual meeting in Richmond in 1956, word was received that Mr. Frank Kizer had been appointed an Assistant Supervisor of Secondary Education in the State Department of Education. A considerable part of his time was to be spent on problems relating to science teaching, science teacher certification and science text books. This appointment represents a real step forward and marks the culmination of an idea which has received strong support from the Academy.

The Education Committee held one meeting in Richmond on November 24, 1956 at which all members but one were present. Mr. Frank Kizer attended by invitation and gave the Committee a broad outline of the plans which were being undertaken by him relating to science education in Virginia. The Committee discussed at considerable length the various angles of science education at secondary and college levels and the very acute shortage of scientists which has developed in recent years. The meeting closed with the idea that an early conference would be held with Dr. Dowell J. Howard to work out a program through which the Education Committee could be of most help to the State Department of Education.

Before final arrangements for the conference could be made, word was received of the untimely passing of Dr. Howard and it has been impossible to hold the conference with Dr. Paschal before the Academy's annual meeting.

Dr. Fred R. Millhiser and your Chairman have been serving this past year on the Committee on Education of Scientists of the Virginia Advisory Legislative Council. This committee was instructed by V.A.L.C. through a joint resolution of the General Assembly to gather information and to determine whether additional steps should be taken at State level to maintain an adequate supply of scientists and engineers and of teachers of these subjects. A public hearing was held in Richmond on January 25, 1957, and a report is in preparation.

Individual members of the Education Committee have been consulted by Mr. Frank Kizer on frequent occasions during the year and have been called upon to participate in several teachers meetings and panel discussions. The list of members who served on the Education Committee in 1956-1957 is attached.

E. H. Crittenden, *Chairman*

REPORT OF THE VIRGINIA JOURNAL OF SCIENCE

Following the appointment of R. T. Brumfield as Editor and C. F. Lane as Managing Editor by the Council of the Academy at the Annual meeting in May of 1956, the editorial and business office of the Virginia Journal of Science was moved from the Department of Biology at the University of Virginia to Stevens Hall of Longwood College.

The administration of Longwood College has been cooperative in supplying transportation to transfer the back copies of the Journal from the University to Longwood. The Librarian has turned over a room in the Library for housing the Journal, giving us the safety of a fire-proof building.

The Journal is faced this year, under a new printing contract, with rapidly mounting costs. For example, the cost of one page of straight printed matter in the old contract was $4.00, under the new contract this cost has doubled to $8.00. This increase is because of increased labor and paper costs. To retain the high quality of past Journals, more financial support for the Journal will be needed in the future.

Rather than read the complete financial statements, I am turning the detailed, audited statement over to the Council for its careful study and consideration. Briefly stated, the receipts this year amounted to $2,686.59, expenses to $3,970.93. With all bills paid to May 1, 1957, there is a cash balance in the bank of $1,606.68, in addition to $43.74 on deposit with Farmville post office and $4.05 cash on hand. The Journal has $2,688.41 in the savings account and thus has a total favorable balance of $4,342.88.

C. F. Lane, *Managing Editor*

FINANCIAL STATEMENT
VIRGINIA JOURNAL OF SCIENCE
May 3, 1956 – April 30, 1957

RECEIPTS:

Academy Subsidy:	
Members	$2,132.50
Advertising	315.99
Subscriptions	229.10
Miscellaneous	9.00
Total of all receipts	$2,686.59

EXPENDITURES:

Reprints	$ 6.50
Printing ($846.56 Jamestown Reprints)	3150.60
Engraving	314.80
Freight	51.88
Postage	130.82
Office Supplies	69.21
Stenographic	212.66
Miscellaneous	30.41
Total of all expenditures	$3,966.88

STATEMENT OF CASH ACCOUNT:

Balance of Cash at Beginning of Year	$2,891.02
Total Receipts for Year	2,686.59
Total Cash on Hand During Year	5,577.61
Less Total Expenditures for Year	3,966.88
Less Balance in Petty Cash Fund	4.05
Balance of Cash per Checkbook	1,606.68
Add Cash on Hand (Petty Cash Fund)	4.05
Add Cash Deposited With Farmville Post Office	43.74
Add Balance in Savings Account	2,688.41
Total Cash as of April 30, 1957	$4,342.88

Audited by Willard G. Leeper
May 7, 1957

REPORT OF JAMESTOWN FESTIVAL COMMITTEE

The Jamestown Festival issue of the Virginia Journal of Science was published on schedule. The title is "Early Virginia." The cover design is by Mr. Horace Day, Professor of Art, Mary Baldwin College. The booklet of 73 pages contains a "foreword" by the chairman of this committee, and the following chapters: "Indians of Virginia 350 Years Ago," by Bruce D. Reynolds, University of Virginia; "Geologic Ancestry of the York-James Peninsula," by Arthur Bevan, formerly State Geologist of Virginia; "Seventeenth Century Science in Old Virginia," by Ivey F. Lewis, University of Virginia; "History of Virginia's Commercial Fisheries," by J. L. McHugh and Robert S. Bailey, Virginia Fisheries Laboratory; "Physicians at Early Jamestown," by Sidney S. Negus, Medical College of Virginia. Two thousand copies have been reprinted.

Elmo Jones of Richmond designed, and the Dietz Press printed, the commemorative jacket for the James River Monograph.

Conferences were held with Parke Rouse, Executive Director, Jamestown Festival, King Meehan, General Manager, Jamestown Festival, A Byron Johnson, Sales Manager, Methodist Publishing House, Charles G. Thalhimer, Vice-President, Thalhimers, and Edward Hyde, President, Miller and Rhoads concerning sale of the Monograph and the commemorative issue of the Journal. It was agreed that they would sell the Monograph for $3.50 ($0.50 commission). These arrangements have been agreed upon by Messrs. Stow, Guy and Brumfield. (Dr. Hobbs was out of the country at the time final arrangements were made.) Copies of the publication are now on sale at the Festival, Cokesbury's Book Shop, Thalhimers, and Miller and Rhoads.

Marcellus H. Stow, *Chairman*

MEMBERSHIP COMMITTEE REPORT

Contacts by letter and in person were made with a large number of prospective V.A.S. members. These efforts included the following:

(1) letters to influential senior members of the Academy asking help to solicit new business memberships

(2) letters sent to science and education faculty members of Virginia colleges and universities — 567 letters

(3) letters to and personal contacts with prospective new industrial members

(4) 183 letters sent to non-member registrants at 1956 Richmond meeting

(5) 1527 letters sent to state high school science teachers

(6) 1265 letters sent to state high school math teachers

The activities of this committee cover the year beginning May, 1956. The membership report below covers this calendar year 1956.

New memberships received during 1956, regular, contributing and sustaining memberships,	85
student memberships	15
TOTAL	100
Members resigned or dropped for non-payment of dues during 1956	
regular	74
student	24
business (closed plant in Virginia)	1
TOTAL	99

The secretary reported that approximately 75 new memberships of all classes have been received during the first four months of 1957. These, of course, are not included in the membership report for the 1956 calendar year.

William R. Smithey, Jr., *Co-Chairman*

Geraldine M. Duncan, *Co-Chairman*.

REPORT OF THE PLACE OF MEETING COMMITTEE FOR 1958

In 1958, the Academy will meet at Hotel Roanoke May 7-10 and will be sponsored by Hollins College, Roanoke College, Virginia Polytechnic Institute, American Viscose Corporation, General Electric Corporation, Norfolk and Western Railway, and the Veterans Administration Hospital. The Academy Council at their May 1956 meeting approved the date May 7-10, 1958 and Hotel Roanoke as the place for the 1958 Academy meeting.

Boyd Harshbarger, *Chairman*

REPORT OF THE PLACE OF MEETING COMMITTEE FOR 1959

On behalf of the University of Virginia and the Place of Meeting Committee of the Virginia Academy of Science for 1957-58 a cordial invitation is extended to the Virginia Academy of Science to hold its annual meeting at Charlottesville, Virginia, during the month of May, 1959.

B. F. D. Runk, *Chairman.*

REPORT OF THE NOMINATING COMMITTEE

The Committee nominated the following for: *President-Elect,* J. C. Forbes; *Treasurer,* Foley F. Smith; *Secretary-Elect,* P. M. Patterson; *Assistant-Secretary,* W. B. Wartman, Jr.; *Council,* Horton H. Hobbs (1962), and T. E. Gilmer (1961).

Allan T. Gwathmey, *Chairman.*

THE ACADEMY CONFERENCE

The Academy was represented at the Academy Conference December 29, 1956, by the Secretary-Treasurer, and President Edward S. Harlow. Brief reports concerning activities of each Academy were given by the representatives of some forty State Academies of Science represented.

The Virginia Academy can well be proud of having one of its members, Mrs. Thelma C. Heatwole, of Staunton, serve as President of the Conference this year. Father P. H. Yancey, of the Alabama Academy of Science was the retiring President.

MINUTES OF THE SECTION OF AGRICULTURAL SCIENCE (1)

PAUL M. REAVES, *Chairman*

JAMES W. MIDYETTE, JR., *Vice-Chairman*

ALLAN H. ALLISON, *Secretary*

C. W. ALLEN, *Section Editor* (1956)

FRIDAY, MAY 10—8:30 A. M.—COFFEE SHOP

1. UTILIZATION OF PASTURE RESOURCES IN VIRGINIA.

Shirley H. Carter; *Virginia Polytechnic Institute.*

This study is a preliminary analysis of how farmers actually use their pastures as measured by livestock production. The data were obtained from a portion of the schedules of the Virginia Livestock Survey of 1951 in which over 7,000 farmers were contacted.

The multiple regression approach is used for the primary analysis. Responses on four types of pastures; blue grass and white clover, blue grass and Lespedeza, orchard grass and Lespedeza and orchard grass and Ladino clover, are studied in each crop reporting district where they are of economic importance. The effect of six factors, calcium, phosphorus, potassium, nitrogen, supplemental pasture and sizes are analyzed.

Carrying capacity expressed in animal units is used as the measure of pasture productivity. Potential carrying capacity as estimated by the livestock farmers surveyed did not prove to be a better measure of pasture productivity than actual carrying capacity except in the "old blue grass region" of the state.

Preliminary analysis of the data revealed a significant difference of carrying capacity between the different types of pastures. Analysis of variance and Tukey's test of additivity were used with a logarithmic transformation of the data for this determination.

For the primary analysis prediction equations were computed for each of the four kinds of pasture in each area studied. Confidence levels and tests of significance were established for each equation. Significance of the different factors studied varied widely for the several pastures studied and in the different areas of the state.

With a very few exceptions size of the operation showed a negative relationship. That is, carrying capacity of the permanent pasture decreased as size of pasture increased; calcium and phosphorus seemed to show little influence on carrying capacity of permanent pasture in Western Virginia and in the Southern Piedmont (districts 4, 7, and 8). Neither of these factors showed any significant results on blue grass and Lespedeza pasture and phosphorus did not give significant results on blue grass and white clover. The effects of nitrogen appear to be most significant on orchard grass and Lespedeza.

The study also includes data on the concentration of the various livestock enterprises in the state. The widespread use of limes and fertilizers are shown by pounds of each element normally applied on each pasture studied in the different areas of the state.

2. LIME REQUIREMENTS OF VIRGINIA SOILS.

W. W. Moschler; *Virginia Agricultural Experiment Station*,
R. K. Stivers; *Purdue University*, and C. I. Rich; *Virginia Agricultural Experiment Station*.

Changes in soil pH values were determined on thirteen Virginia soil types at O, 3, 6, 12, 24, and 36 months after the application of O, 1, 2, 4, and 8 tons per acre of ground dolomitic limestone.

The reaction rates were largely complete at twelve months on most of the soils. In three of the soils pH was still increasing after three years, and had begun to decline in two. The four and eight ton rates were much more effective in promoting a rapid pH increase than the one and two ton rates.

Four of the soils failed to reach the 6.5 to 7.5 range recommended for certain crops in three years with an eight ton per acre application. Six of the soils failed to reach the 6.5 to 7.5 range with a four ton application.

The heavier soils showed a slower rate of reaction and had lower final pH values than the lighter soils, but there were certain soils in both groups which did not follow this trend.

3. THE DETERMINATION OF AVAILABLE PHOSPHORUS IN SEVERAL VIRGINIA SOILS BY FLUORIDE EXTRACTION METHODS.

Clarence C. Gray, III; *Virginia State College*.

Greenhouse and laboratory studies were conducted to investigate

the values of two rapid flouride methods for the determination of available phosphorus in six Virginia soil types. Soil phosphorus was extracted by solutions of 0.03 N NH_4F in 0.025 N HCl and 0.03 N NH_4F in O.1 N HCl. The release of native and applied phosphates for plant use was measured by the phosphorus content of oats grown on the soils under greenhouse conditions.

For the soils studied, both of the rapid fluoride methods were satisfactory chemical measures of available soil phosphorus. The coefficients of correlation between the phosphorus content of the oats and soil phosphorus determined by 0.03 N NH_4F in 0.025 N HCl and 0.03 N NH_4F in 0.1 N were 0.787 and 0.864 respectively.

4. THE USE OF SEED CHARACTERISTICS TO CHECK VARIETY CLAIMS.

J. W. Midyette, Jr., H. L. Smith, and Graham Copeland; *Virginia Department of Agriculture.*

In checking the accuracy of variety claims made on Oats, Soybeans and Barley offered for sale in Virginia, seed characteristics have proven to be very valuable. Many varieties throughout the country have similar seed characteristics even though they may perform differently in the field; therefore, there is a limit to the use of seed characteristics as they relate to variety. However, by cataloguing the characteristics peculiar to each variety distributed in Virginia, we find that in most cases when a definite claim for variety is made it can be concluded from seed characteristics whether or not the seed is acceptable for the variety claimed. If the seed does not carry the characteristics peculiar to the variety claimed we "Stop Sale" on the seed and prohibit its sale bearing a variety claim. Due to the similarity of certain varieties we are unwilling to attempt to designate the variety on seed found mislabeled or seed of unknown variety.

All seed characteristics used to question variety have been correlated with field plantings and found to be dependable. By close study in the laboratory and follow-up plantings, we have been able to catalogue information and reference samples on most all varieties of Soybeans, Oats, and Barley currently grown in Virginia.

5. EFFECTIVENESS OF SUPERPHOSPHATE AND CERTAIN LIMING MATERIALS TOP-DRESSED ON ESTABLISHED PASTURES IN SOUTHEASTERN VIRGINIA.

D. L. Hallock; *Virginia Agricultural Experiment Station, Holland.*

Superphosphate, tagged with radioactive phosphorus (P32), was broadcast on pastures in April 1954 and 1955 at a rate of 50 pounds of

P_2O_5 per acre to determine the extent to which top-dressed fertilizer phosphorus is readily utilized by establishing forages in southeastern Virginia. In general, the percentage of fertilizer-derived phosphorus in the plants 8 weeks after fertilization was similar for both grasses and legumes. On some plots as much as 40 per cent of the phosphorus absorbed by the forages came from the fertilizer and thus the recommendation of top-dressing phosphates appears warranted.

In another experiment with established pastures, 3 liming materials were top-dressed at a rate approximating the neutralizing potential of 2000 pounds per acre of $CaCO_3$. This initial pH level in the plots was 5.7. The pH of the 0 to 1 inch layer increased to 6.1 in one month and to 6.6 in 3 months after hydrated lime (200 mesh) was applied. Similarly, the pH increased to 6.2 and 5.9 in 3 months after application of burnt shell (200 mesh) and dolomitic limes (100 mesh), respectively. At the end of 1 year, the pH values of the 0 to 1 inch layer were 6.8, 6.6 and 6.4, and after 2 years, 6.8, 6.7 and 6.6 in plots treated with hydrated, burnt shell, and dolomitic limes, respectively. The pH of the 1 to 3 inch soil layer had increased to 6.0 by the end of 1 year in the case of all 3 liming materials, but no further increase in pH was observed. None of the liming treatments increased the pH of the 3 to 6 inch soil layer appreciably, during this 2-year experiment.

In both experiments the soil was an imperfectly drained fine sandy loam high in available phosphorus, as indicated by the Truog method.

6. EVALUATING IRRIGATION IN FLUE-CURED TOBACCO PRODUCTION.

Floyd W. Williams; *Virginia Polytechnic Institute.*

Most farm businesses have a limited amount of capital. One of the goals of the farm business is to maximize returns from this limited capital. To do this, the capital must be allocated between factors like fertilizer, machinery, labor and irrigation in such a way that the last dollar invested in each will return the same amount.

To determine the returns to capital invested in irrigation of flue-cured tobacco, 55 farms on which water was applied to flue-cured tobacco in 1956 were studied. Each of these farms was paired with a non-irrigated farm for yield comparison.

Preliminary analysis indicates, on the average, that for a little over three inches of water applied per acre at a cost of about 15 dollars per acre inch about 250 pounds of additional tobacco was produced per acre. Adjustments have not been made for variations in rates of fertilization and planting, varieties and date of planting, soil types or rotations. The final analysis is not expected to differ significantly from an

average standpoint. Further refinement is necessary to determine the response in yield to different amounts of water applied with different rates of fertilization and planting.

7. STUDIES ON FLAVOR DURING STORAGE OF DRIED AND FROZEN CREAM.

W. K. Stone, Mary Kimzey, and G. C. Graf; *Virginia Agricultural Experiment Station*, Blacksburg.

Storage of surplus cream during the flush milk season for later use in manufacture of ice cream may be profitable. Packaging should be inexpensive, protect against contamination, and prevent absorption of odors. Also, off-flavors should not develop during 9 to 12 months' storage.

Composite milk from the Virginia Polytechnic Institute herd was separated at 135° F. The fat in the cream was varied between 40 and 60 per cent, and each batch was heated at 185° F. for 5 minutes. Then part of each batch was packaged in polyethylene-lined paper cartons and stored at -10° F.; the other part was added to condensed skimmilk and spray dried. The dried product was packaged in polyethylene-lined crinkled kraft paper bags and stored at room temperature.

Flavor analyses and fat peroxide determinations were made on each batch of cream immediately after heating and on each stored product initially and each month for 9 months. Fat peroxide values varied between .04 and 1.03, and increases occurred earlier during storage of dried cream than of frozen cream. The increases were accompanied by increases in intensity of oxidized flavor which was more pronounced in the dried cream than in the frozen cream.

8. SOME COSTS ASSOCIATED WITH BROILER PRODUCTION IN VIRGINIA.

James H. Simpson, Jr.; *Virginia Agricultural Extension Service*.

Commercial broiler production is becoming increasingly important in many areas of Virginia, notably in the Shenandoah Valley. The situation in this area as to markets, climate, labor supply, credit, and lack of a more profitable alternative use of underemployed labor has led to this development.

Both producers and those feed dealers who hold broiler production contracts need reliable cost of production data if they are to plan their operations so as to make the most efficient use of their labor and capital. This study was made for the purpose of arriving at some estimates of these production costs that might aid in efficient planning on the part of dealers and producers. A sample of 212 producers in Rocking-

ham County was taken covering the production period July 1, 1954 through June 30, 1955.

An average of all producers in this study indicated that broilers were being produced at a feed conversion ratio (pounds of feed per pound of meat sold) of 3.02. With this feed conversion ratio and under the other average conditions of this study, broilers were being produced at an average cost of 24.9c per pound.

This study also indicated that broiler producers had made rapid progress in several phases of their operations. Labor required per bird has dropped 43% since a similar study was made in 1947-48 while the pounds of feed required to produce a pound of meat has decreased from 4.4 lb. to 3.02 lb. during the same period of time.

9. THE EFFECT OF PROTEIN LEVEL UPON MOLYBDENUM-SULFATE. RESPONSE IN THE RAT.

Russell F. Miller and Nelson O. Price; *Virginia Agricultural Experiment Station.*

Weanling albino rats were fed either 8, 12, or 18% casein in a purified ration, low in sulfate and copper, for a 6-week period. Growth was followed by weighing each rat weekly. At each casein level, the following additions to the diet were made: None; + 2,000 ppm SO_4; + 100 ppm Mo; and + 2,000 ppm So_4 and 100 ppm Mo together. The effect of the addition of 0.3% DL-methionine to the 12% casein diets was further studied. Blood, liver, copper, and molybdenum levels were determined in some lots.

As the casein level of the diet increased from 8 to 18%, the rat growth inhibition caused by 100 ppm of added molybdenum disappeared. The effect of additional casein does not appear to be due in its entirety to the additional methionine supplied by the added casein. Blood, liver, copper, and molybdenum levels were decreased by additional casein.

10. PRELIMINARY OBSERVATIONS ON THE TOLERANCE OF THE YOUNG DAIRY CALF TO ARSANILIC ACID.

W. A. Hardison and D. F. Wilson; *Virginia Agricultural Experiment Station.*

Bull calves of the Jersey and Holstein breeds were fed a limited whole milk diet plus hay and grain which was supplemented with levels of arsenilic acid varying from 0.016 to 0.05% of the total dry ration. The results indicate that this compound is slightly toxic to the young calf at approximately the 0.016% level and is highly toxic at the 0.04-

0.05% level. On autopsy the most characteristic symptom observed was a generalized edema throughout the entire body. There was some indication that Jersey calves were more tolerant to the arsenilic acid than Holstein calves.

11. VIRGINIA 312, A NEW DARK, FIRE-CURED VARIETY OF TOBACCO RESISTANT TO MOSAIC AND ROOT ROT.

R. G. Henderson, R. D. Sears, and Luben Spasoff; *Virginia Agricultural Experiment Station.*

A tobacco root rot, apparently caused by a fungus *Thielaviopsis basicola* and certain pathogenic nematodes, is widespread in the dark fire-cured tobacco area of Virginia. This root rot does not kill the plants but stunts their growth and thereby reduces yields. Tobacco mosaic is not widespread in occurrence but occasionally causes severe damage on certain farms. Varieties of the dark fire-cured type with resistance to these two diseases have not been available. The Walker's Broad Leaf variety has moderate resistance to root rot but is susceptible to mosaic.

The Virginia 312 variety which was released this year has a high level of root rot resistance and carries the Glutinosa type of resistance to mosaic. In advanced yield tests in 1955 and 1956, Virginia 312 produced the highest yield per acre of the six varieties tested, and in 1956 was first in dollar value per acre. In 1955 it ranked second in value per acre. Virginia 312 is somewhat brittle and is thereby subject to storm damage, as was demonstrated in 1955.

12. REGULATIONS OF PESTICIDES IN VIRGINIA.

Paul E. Irwin; *Virginia Department of Agriculture.*

The present Virginia Insecticide, Fungicide and Rodenticide Law has been in effect since July 1, 1948. A pesticide (Economic Poison) is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any insects, rodents, fungi, bacteria, weeds, or other form of plant or animal life which the Virginia Commissioner of Agriculture shall declare to be a pest.

The administration of this Law is broken down into three essential procedures – registration, inspection and analysis. Each pesticide offered for sale in Virginia must be properly registered with the Virginia Department of Agriculture. Graduate chemists serve as inspectors and procure samples which are analyzed in the laboratory to determine if the active ingredients conform with the label guarantee.

During the year 1956, 1001 samples were analyzed and approxi-

mately 10% were deficient. In 1949, 26% of the samples analyzed were deficient.

Approximately 4000 items are currently registered by about 600 registrants. Each year brings forth many new and more powerful pesticides.

A few pesticides are now authorized to be mixed with fertilizers for use on edible crops. A great deal of research is being done on this phase of pesticide application to agricultural products.

13. A GREENHOUSE COMPARISON OF THE RELATIVE PHYTOTOXICITY AND NEMATOCIDAL EFFICACY OF CERTAIN CHEMICAL SOIL TREATMENTS.

W. W. Osborne; *Virginia Polytechnic Institute Extension Service.*

The most serious widespread disease of flue-cured tobacco in Virginia is caused by the root knot nematode (*Meloidogyne* spp.). The severity of this disease can be reduced by chemical soil treatment to reduce the nematode population prior to transplanting the tobacco.

Certain methods and procedures were devised whereas the relative phytotoxicity and nematocidal efficacies of certain chemicals were evaluated using a minimum of greenhouse space, equipment, and labor.

In these greenhouse trials satisfactory root knot and phytoxicity indices were obtained with DD, Vapam, Dorlone, and DCB-60, when applied 7, 14, and 21 days prior to transplanting tomatoes. Nemagon and Thimet gave severe phytotoxicity, V-C 13 did not give satisfactory root knot nematode control. The results obtained from greenhouse trials correlate with results obtained using selected rates of these materials in field trials.

14. EVALUATING NEWER TECHNIQUES IN MILK PRODUCTION AND HANDLING.

Carl W. Allen; *Virginia Polytechnic Institute.*

Many farmers today have a large investment in stanchion type barns with conventional milkers. They are faced with the decision of (1) adding a pipeline milker and/or a bulk tank to the present organization, (2) putting in a separate milking parlor set-up with pipeline, or (3) some modification between these.

Obtaining farmer experience on some of the important costs involved and benefits derived from adding bulk tank, pipeline milker and milking parlor is the objective of the current study.

The economic setting in this problem is within the framework of

substituting one source (capital) for another (labor). We are interested in determining how these two resources substitute for each other. Assuming the output remains constant, what combinations of resources will minimize cost?

The decrease in daily labor per cow as herd size increased was much sharper for the systems including the milking parlor than those with stanchion barns. A smaller "time per day" could be reached with fewer cows with the loose-housing milking parlor arrangement than with stanchion barns.

Translated into "savings" of labor on an annual basis, with the size of herd at the average, the loose housing-milking parlor, pipeline milker, and bulk handling system used about 22 hours less labor per cow than the conventional system used.

15. EFFECTS OF HIGH OXYGEN CONCENTRATIONS ON ASCORBIC ACID AND VITAMIN A IN NEWBORN RATS AND YOUNG GUINEA PIGS.

Jean G. Swartz and C. J. Ackerman; *Department of Biochemistry and Nutrition, Virginia Polytechnic Institute.*

Newborn white rats showed no loss of liver ascorbic acid after exposure to 70% oxygen atmosphere for 10 or 14 days. At a 100% oxygen concentration there was no loss of ascorbic acid after 7 days, but after an exposure period of 10 days at this high concentration the liver ascorbic acid level fell to one-half that of the control group. Brain ascorbic acid levels of the experimental group were slightly lower than those of the control group until the animals reached an age of 14 days. After that age the brain ascorbic acid levels of both groups were comparable. The liver tissue of the young guinea pigs was depleted of ascorbic acid by 34-50% (as compared with the control group) by both concentrations of oxygen. Brain tissue from these same animals showed ascorbic acid levels to be from 14-20% lower than those of the control group. During the course of the experiment the guinea pigs of the experimental group developed an abnormal eye condition which ophthalmoscopic examination revealed to be a type of coronary cataract.[1] Microscopic examination of the eye sections showed retinal degenerative changes in the nerve fiber layer and layer of the rods and cones. There appeared to be a reduction in the number of cells in the ganglion cell layer. None of these abnormalities were seen in sections from eyes of the control animals. The vitamin A studies conducted thus far have shown that this vitamin was not affected in liver tissue from exposed white rats.

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[1] I am indebted to Dr. W. B. Gross of the Animal Pathology Department of Virginia Polytechnic Institute for making the ophthalmoscopic examinations and for preparing and reading the slides.

BUSINESS MEETING

The annual business meeting was held at the close of the session. The nominating committee presented the following nominees for officers for 1957-58: *Chairman,* James W. Midyette, Jr., *Vice-Chairman,* Allen H. Allison; and *Secretary,* C. S. Obenshain. The edtior continues in office. The report was accepted and the above were elected.

MINUTES OF THE SECTION OF ASTRONOMY, MATHEMATICS, AND PHYSICS

MELVIN A. PITTMAN, *Chairman*
EDWARD E. DYER, JR., *Secretary*
IRVING G. FOSTER, *Section Editor*

FRIDAY, MAY 10, 1957 – 10:00 A.M. – VIRGINIA ROOM

1. A STUDY OF INELASTIC SCATTERING OF POSITIVE PIONS.
Paul McCorkle; *College of William and Mary.*

2. MEASUREMENT OF NEUTRON SLOWING-DOWN.
WITH A LIQUID SCINTILLATOR.
George S. Ofelt; *College of William and Mary.*

The properties of neutron slow-down are important to the theory of nuclear reactors since neutrons are slowed down to thermal energy in the moderator. Hydrocarbons have been used as moderators. Since hydrocarbons can also be used as scintillators, it follows that this type of scintillator can be used as the moderator itself. The major portion of the scintillations occur from proton recoil by the collisions of the neutrons with the hydrocarbon nuclei. The distribution of these energy losses can be determined as a function of distance by observing scintillations in the different regions of the moderator. The counting can be facilitated if the moderator is made symmetrical and the neutron source considered as a point source.

For the experimental arrangement the scintillator consists of a solution of toluene, p-terphenyl, and POPOP. A ten millicurie neutron source was used. The photo-multiplier tube was mounted so as to view a conical section of the volume with the vertex at the source. The cone was made of aluminum foil and a series of stops were provided to restrict the photomultiplier tube's observation to a truncated section of the cone. The energy losses of the neutrons as a function of distance from the source could be calculated from the height of each truncation and the number of counts per unit time.

3. SCATTERING OF 3.1 MEV POLARIZED NEUTRONS BY Be^9.

C. D. Bond and F. L. Hereford; *University of Virginia.*

Polarized neutrons emitted at an angle of 53° (cm) from the $D(d,n)He^3$ reactions have been scattered from beryllium and the right-left asymmetry measured as a function of the scattering angle. Neutrons scattered at equal angles to the right and left were detected simultaneously by two 3/4 inch cube stilbene crystals. The counters were differentially biased to reject inelastically scattered neutrons. A thick deuterium "drive-in" target was produced by prolonged bombardment of a water cooled silver disk with a 50 μ a beam of deuterons.

The differential polarization of beryllium was measured in the vicinity of the Be^9 (n,n) Be^9 resonances at 2.73 and 2.85 Mev and the observed angular distribution expanded in a series of associated Legendre functions. The angular dependence exhibited a dominant P^1_2 component with the beryllium polarization reaching a maximum at 60° and 109° (cm) such that $P_nP_{Be}(60°) = \pm 4.76 - 0.99)\%$ and P_nP_{Be} $(109°) = (-6.31 \pm 1.20)\%$.

4. SCATTERING OF PARTIALLY POLARIZED NEUTRONS FROM VARIOUS NUCLEI.

Billy M. McCormac and Frank L. Hereford; *University of Virginia.*

The D-D neutrons with a partial polarization of −10.56 per cent were scattered from various scatterers and the polarization was measured as a function of the angle of scattering.

The theoretical relation for the polarization from a scatterer by partially polarized neutrons is given by

$$P_nP_{SCAT}(\theta_2) = \frac{\sum_e^{\infty} C_e P_e^1 (\cos\theta_2)}{d\sigma/d\Omega},$$

where P_n is the polarization of the incident neutrons and P_{scat} is the polarization by the scatterer as if the incident beam were unpolarized. The coefficients Cl and the differential elastic scattering cross section are determined from a phase shift analysis of the scatterer.

Experimentally the polarization is measured from the right-left aysm-

metry in scattering of the neutrons. The polarization is expressed for $\theta_2 = -53°$ as

$$P_n P_{SCAT}(\theta_2) = -\gamma \frac{1-r^-(\theta_2)}{1+r^-(\theta_2)}$$

where r^- is the right-left asymmetry measured, and where γ is the finite geometry correction.

A comparison is made of the experimental results to the theoretical predictions for carbon and lead. The experimental results are given for Sn and Cu.

5. A VERSATILE HETEROGENEOUS SUBCRITICAL ASSEMBLY.[1]

T. M. Schuler, Jr., A. Robeson and T. H. Hahn, Jr.; *Virginia Polytechnic Institute.*

A natural-uranium, graphite-moderated exponential pile has been constructed utilizing approximately 30,000 pounds of AGOT grade reactor graphite and 2,500 pounds of natural uranium slugs. The assembly consists of a cube of graphite 6 feet on a side containing 1 inch diameter uranium rods arranged in a lattice with eight inches between fuel rod centers. The assembly rests on a graphite pedestal 2 feet high containing a 15 curie polonium-beryllium source emitting 3 x 10^7 neutrons per second. Measurements of the properties of the moderator yield a diffusion length of 57.5 centimeters and a Fermi Age of 357 square centimeters. The multiplication and material buckling of the fuel moderator system lead to a critical size of 18.5 feet on a side.

6. RADIO STAR SCINTILLATION STUDIES AT THE UNIVERSITY OF VIRGINIA DURING THE INTERNATIONAL GEOPHYSICAL YEAR.

E. C. Stevenson and Jack T. Smith; *University of Virginia.*

This project in the program of the International Geophysical year should give information about the winds in the upper atmosphere and about the composition of the upper ionosphere. The electromagnetic radiation in a narrow band about 100 ke/sec wide centered at 39 Mc/sec received from an intense "radio star" source will be recorded simultaneously at three stations. These are located a mile or two apart at the vertices of a right triangle. From a study of the auto-and cross-correlation functions of the fluctuating signals received, it is possible to esti-

[1] Supported in part by the U. S. Atomic Energy Commission.

mate the size and shape of the ion clouds in the upper atmosphere which are responsible for the fading effects and to deduce the drift velocities of these clouds.

7. POPULATION GROUPS AMONG RED DWARF STARS.

A. N. Vyssotsky; *University of Virginia.*

It has been suggested by several investigators (Delhaye, Baade, Ambarzumian) that red dwarf stars with emission lines in their spectra are recently formed young stars. A study of the distribution of velocity vector points of the two groups of red dwarfs, one comprising those with emission line spectra and the other, the remaining red dwarfs, has been made at the McCormick Observatory. The diagrams show clearly that the stars of the first group are intimately connected with the spiral arms of the galaxy, thus substantiating the assumptions as to the age of these stars.

8. AN UNUSUAL VARIABLE STAR.

Charles Cowley and George Mumford III;[1] *University of Virginia.*

The variability of BD + 37°2318 has been discovered. Spectral range is from B5 to K2; magnitude range is from 11.6 to 9.3 photographic. The galactic latitude is +81°; the proper motion is small. It is suggested that the star may be related to Z Andromedae and similar stars. It is presumed that stars of this type consist of two components, a red giant with small light variation and a nova-like white component which occasionally explodes.

9. EXPERIENCES IN OPERATING A COLLEGE PLANETARIUM.

A. Roland Jones; *The Sale Planetarium, Virginia Military Institute.*

In the year that has elapsed since I found myself in charge of a brand-new planetarium, responsible for its programs, the chief problem before my mind has been how to make the best use of the planetarium in a college course in astronomy.

The solution I have arrived at, oddly enough, did not come entirely from my experience with students, but in some measure from giving performances to school children and to the general public.

This side of the work, begun as a public service, soon began to show its value in pointing the way to the ideal course lecture. The chil-

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[1] Now at Tufts University.

dren, sufficiently young not to be too prejudiced in favor of the other "star" entertainments, television, and the Hollywood film, provided the perfect barometer for the planetarium atmosphere; the general public audiences made it necessary that the programs should balance the technical interests with human ones.

The course lecture that has evolved consists of a ritual which begins with the professor's demonstration using the planetarium installation (in the Sale Planetarium, a Spitz, A, Model); proceeds to individual work on assignments at blackboards surrounding the room, and concludes with a verbal recitation beneath the stars.

This arrangement, I believe, answers the criticism sometimes heard that the planetarium, like the scientific film, can only be of occasional use in college astronomy. Thanks to its versatility, the planetarium can give to every lecture the inspirational note which is the essence of teaching.

10 A RECORDING ACCELEROMETER.

I. G. Foster; *Virginia Military Institute.*

A self contained mechanical recording accelerometer capable of reading acceleration pulses of amplitude 5000-10000 g, and periods of a few milliseconds has been proposed by staff members of the Diamond Ordnance Fuze Laboratories. A stylus is fixed at the end of a cantilever. The beam is mounted in a small steel box, so that the vibrating stylus scratches a spring driven disc. This disc rotates in a plane parallel to the plane of vibration of the cantilever so that a trace of the motion is produced.

To obtain accurate records of the cantilever vibration a simple photocell circuit was used, such that the motion of the end of the cantilever varied the intensity of a light beam. Analysis of these records showed that the damping was quite closely proportional to the velocity of the cantilever. It was also found that the relative magnitudes of the various modes are accurately predicted by theory.

Comparison of theoretical and experimental vibration patterns when known acceleration pulses are applied to the accelerometer indicate that information in regard to amplitude and duration may be accurately determined. Information as to the shape of the pulse will be less precise.

11. DESIGN AND CONSTRUCTION OF A THERMAL DIFFUSION COLUMN FOR PURPOSE OF ISOTOPE SEPARATION.

William T. Eley; *College of William and Mary.*

The idea that isotopic separation occurs in gases subjected to a

high temperature gradient was mentioned by James Cork in his book *Radioactivity and Nuclear Physics.*[1] He refers to papers published by Clusius & Dickel,[2] A. K. Brewer & A. Bramley,[3] H. C. Urey, and A. O. Nier.[5] The present work of this experiment, based on the information from these papers is the design and construction of a thermal diffusion column that can be duplicated in the ordinary college physics laboratory.

The column itself is made of three concentric copper pipes 1½", 1" and ½" with a nichrome heating element enclosed in a fused quartz tube. The 1½" pipe is the water jacket, the ½" pipe holds the heating element and between the ½" and 1" pipe is the gas space. At each end of the column is a copper reducing tee in order to supply a water tap. The gas space is sealed on both ends by a galvanized ring.

To analyze the gas samples most of the above mentioned authors used a mass spectrometer. Nier used this instrument to determine the presence of isotopic separation. However, since a mass spectrometer is not a standard piece of equipment in a college laboratory, two simpler and less expensive methods are available.

1. Chemically, by using gases that will separate easily into component gases. For instance upon separation, the oxygen and nitrogen of air can easily be tested with a burning splint.

2. Physically, by weighing samples and determining the molecular weight.

12. EXPERIMENTS WITH STRINGED INSTRUMENTS.

Robert E. Smith; *College of William and Mary.*

13. FARADAY EFFECT IN COMBINED MAGNETIC AND RADIO FREQUENCY FIELDS.

When an atomic or molecular system is acted on by two perturbations simultaneously, the response to the first perturbation may be strongly influenced by the presence of the second if the latter coincides with a natural resonance of the system.

In the present work the system is an atom or a molecule in a DC

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[1] James M. Cork — Radioactivity & Nuclear Physics.

[2] K. Clusius and G. Dickel — nauturwiss 26, 546 (1938); 27, 148 (1939).

[3] A. K. Brewer and A. Bramley — Physics Review 55, 590 (1939).

[4] H. C. Urey — Jour. App. Phys. 12, 270 (1941).

[5] A. O. Nier — Phys. Rev. 57, 30 (Jan. 1, 1940).

magnetic field; the first perturbation is a plane polarized light wave, and the second a radio frequency field. The plane of polarization of the light wave is rotated by passing through the system parallel to the magnetic field, and anomalies in this rotation due to the presence of a radio frequency field at one of the resonant frequencies of the system (e.g. proton resonance in water) are sought.

Preliminary experiments and instrumentation are described.

14. HEAT TRANSFER BETWEEN SOLID PARTICLES AND GAS IN A ROCKET NOZZLE.

Peter L. P. Dillon and Lloyd E. Line, Jr.; *Experiment Incorporated.*

The effect on rocket performance of the degree of heat transfer between solid particles and gas as the mixture is exhausted through an expansion nozzle was calculated.[1] The working fluid was assumed to consist of 8 parts by weight of solid carbon and 1 part of hydrogen in thermal equilibrium at 2000°K and 25 atmospheres in the chamber, expanding adiabatically through a nozzle of assumed configuration to an ambient pressure of 1 atmosphere.

For the extreme case of no heat transfer (carbon exhausted at 2000° K) the loss in specific impulse should be only 12%. The loss in impulse associated with the retention of enthalpy by the carbon is offset somewhat by the fact that hydrogen expands to a temperature about 600° below that for the case of complete thermal equilibrium.

A calculation of the more realistic case of partial conductive heat transfer showed an expected loss in specific impulse of less than 1%. Carbon particles 0.01 micron in radius were assumed. Since the mean free path of hydrogen gas is larger than the carbon particle, the rate of heat transfer was calculated with the aid of the kinetic theory of gases and a thermal accommodation coefficient reported in the literature.

This work was supported by the Department of the Navy, Bureau of Ordnance.

15. CONDUCTIVITY OF A STILL GAS WITH VOLUME IONIZATION.

William E. Rice; *Experiment Incorporated.*

Thomson's theory[2] of electrict conduction in ionized gases has been employed extensively, but reasons for distrusting it are reported here. The theory applies to gases in which ions are produced continually in

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[1] Peter L. P. Dillon and Lloyd E. Line, Jr., Jet Propulsion, 26, 1091 (1956).

[2] J. J. Thomson and G. P. Thomson, Conduction of Electricity through Gases, New York, The Macmillan Co., 1928.

every volume element, and migrate between electrodes according to the ordinary diffusion laws. By ignoring ion concentration gradients, keeping only the electric field as a driving force for diffusion, it is possible to reduce the problem to integration of one differential equation.

Experiments show that there are "sheaths" at the electrode surfaces. The field strength varies rapidly with distance in the sheaths, but is nearly constant between them. To solve the difficult case of electrons as the negative carriers, Thomson divided the gas artificially into regions corresponding to the sheaths and the intervening space. He ignored recombination in the sheaths, and made the field exactly constant between them.

The present author integrated the differential equation numerically without introducing sheaths artificially. The occurrence of sheaths was not predicted. This means that the differential equation ignoring concentration gradients does not describe the phenomena correctly. The input data were for flames, in which much of the experimental conductivity research has been performed.

The Air Research and Development Command supported this work.

16 .CHEMI-IONIZATION IN FLAMES.

Willard E. Meador, Jr., *Experiment Incorporated.*

Calculations show that abnormal ion concentrations in flames, particularly those in which organic fuels are burned, cannot be accounted for on the basis of thermal dissociation; thus some other mechanism must be sought. A theoretical investigation has been underway at Experiment Incorporated since September, 1956, sponsored by Project SQUID, to determine quantum mechanically whether or not certain ionized-product chemical reactions can take place under flame and rocket conditions.

The first step in such a project is to calculate the appropriate potential energy surfaces for each reaction to be considered. If it should happen that the surface corresponding to ionized products "crosses" or approaches the one leading to un-ionized products (the latter in each case being derived from electronically excited reactants), there will be a finite probability that a "jump" from one to the other will take place. These transition probabilities, and thus transmission coefficients, can be determined quantum mechanically for use in Eyring's reaction rate theory.

Thus far extensive work has been done in the outer regions of these surfaces with calculations now having begun in the inner regions using

modifications of the Roothaan self-consistent field procedure; the numerical iterations being accomplished on the NORC at Dahlgren, Virginia.

17. MEASUREMENT OF LIFETIME OF MINORITY CARRIERS IN SINGLE SILICON CRYSTALS.

Stanley R. Jones and T. E. Gilmer, Jr.; *Experiment Incorporated.*

A photoconductive decay apparatus for the measurement of minority carrier lifetimes in semiconductors is described, and some of the results obtained with silicon are presented. The apparatus makes use of a special spark light source which gives a light pulse of 0.2 microseconds duration as measured with a photomultiplier; a wide-band amplifier and oscilloscope are used for amplification and display of the photoconductive signal. Some of the results which have been obtained with this apparatus on samples of single crystal silicon (grown by the Czochralski technique) are presented. In particular, the variation of lifetime with distance from the center of one single crystal pull is shown; the lifetime decreases almost linearly with distance from the center, an effect believed due to an increase in crystalline defects in the outer portions of the crystal. In some p-type crystals it is found that lifetime is a function of ambient light intensity, increasing linearly with increasing ambient light up to a point and remaining constant for further increases in light intensity. A similar dependence on spark light intensity is found. No such dependence has been found in any of n-type crystals investigated at this laboratory.

18. DEFINING FUNCTIONS.

Robert C. Yates; *The College of William and Mary.*

The trigonometric and logarithmic functions are basically and most satisfactorily defined by power series. The purpose of this paper is to show that such series completely define these elementary transcendental functions and that all familiar properties evolve directly from the series. Of particular interest are several matters: the development of the sine and cosine of the sum; the discovery of the periodic character of the trigonometric functions; and the derivation of the three fundamental properties of the logarithm.

It is necessary to assume that the term-by-term differentiation of a power series that defines a function produces a new series that defines the derivative of the function at least within the same interval of convergence.

It is recommended that a similar treatment be given to students before completing a first course in calculus.

19. APPROXIMATION TO AN ALGEBRAIC IRRATIONAL NUMBER BY A SEQUENCE OF TRANSFORMATIONS ON QUADRATIC FORMS.

Reuben R. McDaniel; *Virginia State College.*

It has been shown in a previous paper[1] that there exist a finite sequence of linear transformations, the product of which will carry the quadratic form

$$F = \sum_{t=i}^{n} A_t \left(\sum_{i=1}^{n} X_i \, \alpha_t^{i-1} \right)^2 + \sum_{t=1}^{s} B_t \left(\sum_{i=1}^{n} X_i \, \beta_t^{i-1} \right) \left(\sum_{i=1}^{n} X_i \, \gamma^{i-1} \right)$$

into a quadratic form

$$F_1 = A_1 \left(\sum_{i=1}^{n} Y_i \, \alpha_1^{i-1} \right)^2 + \sum_{t=2}^{n} K_{1t} \, A_t \left(\sum_{i=1}^{n} Y_1 \, \alpha_t^{i-1} \right)^2 + \sum_{t=1}^{s} K_{2t} \, K_{3t} \, B_t \left(\sum_{i=1}^{n} Y_i \, \beta_t^{i-1} \right) \left(\sum_{i=1}^{n} Y_i \, \gamma^{i-1} \right)$$

where α_t $(t = 1, 2, \ldots n)$ and real roots and β_t and γ_t are conjugate imiginary roots of a rational algebraic equation in one unknown of degree $n + 2s$. Also, K_{1t} and K_{3t} are algebraic numbers in the field of α_t.

Let T be the transformation that takes F into F_1 where (a_{ij}) is the matrix of its transformation. Furthermore, we designate the matrix of

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[1] Abstracts of Doctors of Philosophy Dissertations, Cornell University, 1938.

T^r as $(a_{ij}^{(r)})$, X being a positive integer. $(r = 1, 2, 3, \ldots)$

In order for T to take F into F_1 it is necessary that

$$\frac{\sum_{i=1}^{n} a_{ij} \int_t^{i-1}}{\sum_{i=1}^{n} a_{i1} \int_1^{i-1}} \equiv \int_t^{j-1} \qquad \frac{\sum_{i=1}^{n} a_{ij} \beta_t^{i-1}}{\sum_{i=1}^{n} a_{i1} \beta_1^{i-1}} \equiv \beta_t$$

and

$$\frac{\sum_{i=1}^{n} a_{1j} \gamma_t^{i-1}}{\sum_{i=1}^{n} a_{i1} \gamma_1^{i-1}} = \gamma_j \qquad (j=1, 2, 3, \ldots, n)$$

From these identities it can be shown that in the matrix $(a_{ij}^{(r)})$

$$\lim_{r\to\infty} \frac{a_{1i}^{(r)}}{a_{1,\,i+1}^{(r)}} = R(\text{a constant}) \quad i = (1, 2, \ldots n-1)$$

If the algebraic equation considered is of the form $X^n = P$ where the nth rooth P is irrational, it has been shown that $R = \sqrt[n]{P}$.

20. A MAGNETICALLY DRIVEN ULTRACENTRIFUGE.

D. Rae Carpenter, Jr. and Jesse W. Beams; *Virginia Military Institute* and *University of Virginia.*

The magnetically suspended equilibrium ultracentrifuge has become an increasingly important tool for measurement of molecular weights. An ultracentrifuge driven by a rotating magnetic field was constructed and attained speeds of 515 rps. The rotor, essentially a cylinder 4¼ inches in diameter and 3 inches high, was made of steel having a lower duraluminum portion in which were imbedded four permanent magnets.

Weight slightly exceeded nine pounds with a moment of inertia of 57,000 gram centrimeters.

The electromagnetic driving coils were located beneath and outside the vacuum chamber. A signal for driving frequency was taken from the rotor itself up to operating speed after which an audio oscillator provided constant frequency operation as a synchronous motor.

A multiple reflection type interferometer was used for observing the change in concentration of the solution being centrifuged. Localized fringes were formed by gold coatings on two glass windows separated by a wedge shaped disc having a sector shaped opening.

A solution cell was located 1 3/4 inches from the rotor axis. This cell had quartz windows forming its end and held a smaller cell inside containing the gold coated windows. Measurements of molecular weights with this centrifuge are now being attempted.

21. SOME IMPROVEMENTS IN THE OPTICAL SYSTEM OF THE ULTRACENTRIFUGE.

K. D. Williams, B. V. English and J. W. Beams; *University of Virginia.*

The optical system contains a modified Jamin interferometer. The interferometer consists of a beam splitter and a set of plates forming an air wedge. The beams produced by the beam splitter are recombined in the second set of plates and localized interference fringes are formed in the plane of the cell. The angle of the wedge determines the number of fringes in the field of view.

Since the fringes formed are parallel to the vertex of the wedge, the wedge may be rotated so that the fringes are either parallel (vertical) or perpendicular (horizontal) to the radial length of the cell image.

The "vertical" fringes draw a picture of the concentration gradient in the cell but are difficult to measure. The "horizontal" fringes are more easily measured.

The new system uses three beams with two of them passing through the solvent and one through the solution. This produces two distinct sets of fringes. The set due to the two beams in the solvent shows no change when the system is in equilibrium.

22. DETERMINATION OF TENSILE STRENGTH AND ADHESION BY CENTRIFUGAL TECHNIQUE.

R. N. Bundy and J. F. McArdle; *University of Virginia.*

Recent work at the University of Virginia has indicated that there

is a marked dependence of the tensile strength and adhesion of thin films of metals upon the film thickness. In this experiment, further study of this dependence has been made using thin silver films electrodeposited on one-half millimeter cylindrical steel rotors. These films are spun in a magnetically-supported, magnetically-driven ultracentrifuge until the film yields, in the case of tensile strength determination, or until the film patches break away from the rotor for determination of adhesion. The advantage of this method is that the stress developed is nearly uniform and unidirectional. The results thus obtained confirm earlier work on the subject. Further research is being done to determine the stress-strain relationship for films while they are being subjected to centrifugal stresses. Strain is determined by measurement of the change in film diameter on spark microshadowgraphs taken while rotor is spinning. Preliminary data indicate that maximum value of the adhesion for each particular rotor and film can be determined in this manner.

23. MECHANICAL STRENGTH OF POLYCRYSTALLINE GOLD AND SILVER FILM[1].

A. L. Stamper, D. E. Kraft and T. Strider; *University of Virginia.*

The "bulge" technique has been employed to determine the mechanical strength of polycrystalline gold and silver film as a function of film thickness. The metal film was evaporated over the open end of a hollow cylindrical tube and air pressur eapplied until the film broke. The amount of bulge was measured at various air pressures inside the tube. From these data the tensils strength can be determined[2] and stress-strain curves obtained. The tensils strengths are practically constant (1.10×10^9 dynes cm^2 for silver and 0.90×10^9 dynes/cm^2 for gold) at thicknesses greater than the critical thickness (2.5×10^{-5} cm for silver and 2.0×10^{-5} cm for gold). At thicknesses below these critical thicknesses there is a marked increase in tensile strength. The stress-strain curves show that plastic flow is considerable less in the thin polycrystalline film than in the bulk metal (for example, a silver or gold wire).

24. TENSILE STRENGTH OF LIQUID HELIUM.

J. W. Beams; *University of Virginia.*

The tensile strength of liquid helium below the lambda point was measured by three methods. The first was a piston cylinder method, the

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[1] Supported by the Office of Ordnance Research, U. S. Army.

[2] A. G. Gleyzal, trans, Am. Soc. Mining Met. Engrs. 70, 288 (1948).

second a centrifugal method and the third a method which employed rapid linear acceleration. All three methods gave values of the same order of magnitude. The centrifugal method was the most precise and gave values of .14 ± .02 atmosphere for the tensile strength.

25. PROPERTIES OF ZINC WHISKERS GROWN BY VAPOR DEPOSITION.

R. V. Coleman, P. B. Price and N. Cabrera; *University of Virginia.*

Single crystal whiskers of zinc and cadmium have been grown by vapor deposition, exhibiting phenomenal properties indicative of a high degree of perfection. Some whiskers have hexagonal plates growing from them having the same crystallographic orientation as the whiskers, usually with the c-axis making an angle of about 30° with the axis of the whisker.

Tensile tests have been performed on the whiskers at various temperatures. At room temperature the yield stress is about 4 x 109 dynes/cm² and the yield strain about 1%. All whiskers tested were strong, with no observable size effect in the range from one to eight microns. After the slip is incubated, a very small stress is required to cause plastic deformation, with definite slip bands propagating over the whisker for a constant stress.

At liquid nitrogen temperature cadmium whiskers behave in a qualitatively similar way, although the elastic stress and strain are about 50% higher. Zinc whiskers, having a higher melting point, are much stronger than at room temperature. The strain is so great that a deviation from Hooke's Law is observed. There is no plastic deformation; when the elastic limit is exceeded, the whiskers fractures with the release of considerable elastic energy which deforms the fragments.

26. ON THE MAXWELL-BOLTZMANN ENERGY DISTRIBUTION: ADVANTAGES OF INCLUDING A CONSTANT OF PROPORTIONALITY IN THE DEFINITION OF PROBABILITY[1].

David E. Lundquist; *Newport News High School.*

From the book, *Theoretical Physics*, by Joos and Freeman, (Hafner, New York), page 578, lines 16-17, one reads, "Then, by Liouville's theorem, each (cell volume Δr_i) will have an *a priori* probability

[1] Study made under the guidance of Dr. Eugene E. Lundquist, the author's father.

proportional to its size." Inclusion of the missing constant of proportionality in equation (25) renders all equations of the derivation dimensionally correct. This inclusion can be effected if, in the numerator,

$$(\Delta r_i)^{f(i)\Delta r_i} \text{ is replaced by } \frac{(\Delta r_i)}{g}^{f(i)\Delta r_i}$$

where 1/g is the constant of proportionality, g being a phase space volume as is also Δr_i . With this change, the following corrections must be made to the equations of the derivation: in equations (26), (29), and (30), log f(i) becomes log f(i)g; in equations (31) and (32), A becomes A/g; in equations (35), (37), and the unnumbered equation following equation (43), log σ becomes log (σ/g).

Another advantage of including a constant of proportionality in the definition of probability lies in the clear implication at the beginning of the analysis that there does exist a fundamental unit of phase space volume. The fact that this unit of phase space volume, g, is related to Planck's constant[2] helps in understanding the role played by Planck's constant in the theory of the Maxwell-Boltzmann energy distribution.

27. NOMOGRAPHIC DIAGRAMS FOR THE SOLUTION OF KEPLER'S EQUATION.

A. H. Mason; *Office of Chief of Staff, United States Army.*

In calculating the elements of the orbit of a comet or asteroid, a transcendental equation, M = E − e sinE must always be solved. Definitions of parameters follow:

M = Mean anomaly of celestial object
E = Eccentric anomaly
e = Orbital eccentricity .

A linear relation exists between M and e. Nomographic diagrams of M versus e in small steps of E can therefore be prepared.

Let it be required to solve Kepler's Equation for the following values of the parameters:

M = 1.8765432 radian
e = 0.2641546

Graphical interpolation on the diagrams gives a preliminary value of E = 120°33'12". This will be slightly off, but E is bracketed by 120°33'

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[2] Compare g with h_s in notation of equation (44), page 580.

and 120°34'. The following scheme leads to the precise value.

E = 120°33'00"	M = 1.8765082 radian
E = (Value to be obtained)	M = 1.8765432
E = 120°34'00"	M = 1.8768381

Now split 60" to fit M. Therefore increment in E = 06."4

E = 120°33'06."4

We therefore have a system of nomographic diagrams from which the solution to Kepler's Equation may be taken directly with an error of a few seconds, depending on M. A linear interpolation leads to a value of the eccentric anomaly, correct to less than a half-tenth of a second.

Actually 320 diagrams of the type here shown have been prepared and indexed.

The diagrams will do the work of a table of 314,160,000 entries.

BUSINESS MEETING

At its business meeting the membership elected the following new officers: *Chairman*, Edward E. Dyer, Jr.; *Secretary*, Jackson J. Taylor; *Section Editor*, Irving G. Foster.

MINUTES OF THE SECTION OF BACTERIOLOGY

WESLEY A. VOLK, *President*

BARBARA CAMINITA, *Vice-President*

MILES HENCH, *Secretary*

P. ARNE HANSEN, *Section Editor* (1957)

FRIDAY, MAY 10, 1957—11:00 A.M.—CHAMBERLIN CLUB TV ROOM

1. A STUDY OF BACTERICIDIN LEVELS IN SERA FROM HUMANS WITH MYOCARDIAL INFARCTION.

George Naff; *Department of Microbiology; University of Virginia, School of Medicine.*

A Bactericidal system for *Bacillus subtilis* characterized by requiring calcium and bicarbonate ions for activity was studied in the sera of normal adults and patients following acute Myocardial Infarction. A system similar to this was described by Jacox requiring calcium ions for activity.

One unit of Bactericidin was arbitrarily defined to represent the minimum amount of Bactericidin contained in one ml. volume capable of inhibiting the growth of the standard inoculum.

In a series of determinations of the sera of fourteen healthy adults, the Bactericidin level was observed to be two units per ml. or less. In a comparative study of five patients diagnosed as having acute Myocardial Infarction, a marked rise of Bactericidin levels was observed. On the first day following the symptoms of Myocardial Infarction the Bactericidin levels were usually within normal limits. However, these levels began to rise on the second post symptom day and reached a maximum of 4 to 16 times their initial concentration by the 4th to the 5th post symptom day. The decline in Bactericidin levels was relatively rapid with a normal titer about the 14th day after the onset of symptoms.

This Bactericidin was also elevated in patients with lobar pneumonia, and some patients with advanced metastatic carcinoma.

This Bactericidal system may represent a model of a non-specific immune mechanism that is increased during certain stress conditions.

2. SOME OBSERVATIONS ON PH CONTROLLED *Endamoeba histolytica* CULTURE.

E. Clifford Nelson and Muriel M. Jones; *Medical College of Virginia.*

In test tube cultures of *Endamoeba histolytica* it was observed that hydrogen ion changes take place more rapidly in the bottom of the tube than at the top. By means of careful sampling it was found that notably different readings could be obtained from the top of the culture, the bottom of the culture and after mixing. Only the reading from the bottom where the amebae grow can be considered as the true reading, to be related to the growth and multiplication of the organism. Tests were run on cultures of buffered media at pH 6.4, 6.8, 7.2 and 7.6. Growth and multiplication of amebae were observed to ensue promptly in acid medium but in alkaline medium only after a shift in pH to the acid range. Multiplication was observed in cultures which had dropped to as low as pH 5.7.

3. IDENTIFICATION OF *Escherichi coli* BY THE FLUORESCENT ANTIBODY TECHNIQUE[1].

Walter R. Dowdle; *Department of Bacteriology, University of Maryland;* Margaret Green and Mildred A. Engelbrecht; *Department of Bacteriology, University of Alabama.*

This investigation was undertaken to determine the sensitivity and specificity of the fluorescent antibody technique for the detection and identification of *Escherichia coli.*

One hundred and twenty eight strains of *E. coli* isolated from natural sources and 55 strains of other bacteria were exposed to fluorescein-labeled *E. coli* strain ATCC 26 antibodies.

Maximum fluorescence of the *E. coli* strains occurred at the age in which the cell has the greatest surface area, e.g., the upper lag phase of the growth cycle (age 2 hours at 37° C). By exposing 2 hour cultures to labeled antibodies, immunochemical staining as a means of identifying *E. coli* isolates was found to be more sensitive than conventional agglutination tests. Forty five percent were fluorescent positive. Twenty six percent were agglutinated with unlabeled antisera.

Each *E. coli* isolate exhibited a characteristic reaction with labeled antibodies. The reactions were graded as minus to 4-plus fluorescence. The extreme low-order (one-plus) and the minus fluorescent reactions were considered negative.

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[1] This work was performed under contract with the Chemical Corps, Fort Detrick, Frederick, Maryland.

Labeled *E. coli* antibodies were not completely specific for *E. coli*. Several strains of *Aerobacter* and *Escherichia* species exhibited cross-fluorescence, and a low-order non-specific fluorescence was encountered with the *Bacillus* species.

4. THE GROWTH OF HELA CELLS IN ANTI-HELA CELL SERUM.

Gerald Goldstein; *Department of Microbiology, School of Medicine, University of Virginia.*

HeLa cells have been propagated for 14 subcultures in medium containing antibodies directed against HeLa cells. These antibodies were produced by injecting rabbits with extracts of HeLa cells.

The addition of rabbit serum containing antibodies directed against HeLa cells and complement destroys HeLa cells within 15-30 minutes. By omitting complement it has been possible to propagate HeLa cells in the presence of antibodies for Hela cells. Cultures of these cells contain bizarre shaped cells and many clumped cells. The majority of the cells appear normal. The addition of complement to cells that have been washed in an attempt to remove the antibodies still produces rapid cellular destruction.

5. COMPARISON OF ISOLATION TECHNIQUES AND METHODS FOR THE DIAGNOSIS OF ONYCHOMYCOSIS.

Muriel M. Jones, J. Douglas Reid and Albert Pincus; *Department of Microbiology, Medical College of Virginia.*

One hundred fifty specimens of nails presenting a diagnostic problem were investigated for the presence of a fungus. The efficiency of the potassium hydroxide wet mount direct examination was found to be comparable to that of the Periodic Acid Schiff Base staining technique for disclosing mycelial elements but inferior to the latter in demonstrating small yeast-like fungi. The PAS stain also has the advantage of permanence.

The isolation potentials of Mycosel, Sabouraud's Agar with penicillin, streptomycin and Actidione and Sabouraud's without antibiotics were compared. Plain Sabouraud's proved inferior to the other two media but there was no notable difference in the efficiency of Mycosel and Sabouraud's with freshly added antibiotics.

The relation of the number of positive cultures obtained (26%) to the positive direct examinations (50%) is discussed.

The organisms isolated were *Trichophyton rubrum*, *Trichophyton mentagrophytes*, a single *Candida albicans* and a small lipotrophic yeast of undetermined significance.

6. OBSERVATIONS ON HUMAN NASAL MUCOSA IN TISSUE CULTURE.

Catherine M. Russell; *Department of Microbiology, University of Virginia.*

Explants of human nasal mucosa were cultured in roller tubes and pooled human sera were used in the nutrient media. The epithelial cells which grew out from the explants disintegrated in about 10 days. Sheets of fibroblasts completely replaced the epithelial cells. Seventy days later small areas of epithelial-like cells appeared in the culture. The epithelial-like cells continued to grow and completely replaced the fibroblasts. The epithelial-like cells were mechanically separated from the parent culture and subcultured. The new epithelial-like cell line derived from nasal mucosa is now in its 12th passage and will be studied for its sensitivity to upper respiratory tract viruses.

MINUTES OF THE SECTION OF BIOLOGY (4)

JACK D. BURKE, *Chairman*

HARRY L. HOLLOWAY, *Secretary*

ROBERT T. BRUMFIELD, *Section Editor* (1957)

FRIDAY, MAY 10, 1957 – 9:00 A. M. – ROOF GARDEN

1. PRELIMINARY SURVEY OF AQUATIC HYPHOMYCETES ON ANGIOSPERM DEBRIS.

Clyde J. Umphlett; *Virginia Polytechnic Institute.*

A preliminary taxonomic survey of the aquatic hyphomycetous flora characteristically growing on submerged, decaying angiosperm debris was conducted in Montgomery County, Virginia. The best natural substrata for development of these fungi were leaves which had been reduced to skeletons by decay. The following species were observed, and sporogenesis in each was discussed: *Alatospora acuminata* Ing., *Lemonniera aquatica* De Wild., *Anguillospora longissima* (Saac. and Syd.) Ing., *Lunulospora curvula* Ing., *Tetracladium marchalianum* De Wild., *T. setigerum* (Grove) Ing., *Tricladium angulatum* Ing., *T gracile* Ing., *Triscelophorus monosporus* Ing., *Campylospora chaetocladia* Ranz., *Clavariopsis aquatica* De Wild., *Tetrachaetum elegans* Ing., and *Heliscus tentaculus* n. sp. The latter species was proposed as a new species.

2. HYBRIDIZATION IN *Ipomoea* AND ITS RELATIVES.

Robert J. Knight; *The Blandy Experimental Farm, University of Virginia.*

Interspecific hybridization is rare in morning glories, although it has been claimed respectively for *I. Batatas, I. pandurata, I scabra, I. Horsfallii, I. hederacea* and *I. purpurea.* The sweet potato is considered of probable alloploid origin. *Merremia digitata,* reported by Watanabe to have 58 somatic chromosomes, is probably an amphiploid. Sterile plants from the artificial hybridization of *I. coccinea* x I. *Quamoclit* are discussed. *I. Sloteri* is almost certainly the amphiploid of this hybrid. Interaction of genes from orange-colored *I. coccinea* x white-flowered *I. Quamoclit* produced a hybrid having scarlet flowers similar to normal *I. Sloteri.* Variety "Hearts & Honey" differs from normal *I. Sloteri* in having an orange flower similar to that of *I. coccinea.*

The following genic compositions are suggested as controlling flower color in cypress-vine, star-glory, and cardinal climber. *I Quamoclit*, Red, CR/-R; *I. Quamoclit*, White, cR/cR; *I. coccinea*, Orange, light center, Cr/-r; *I. coccinea* x *I. Quamoclit*, Scarlet, Cr/R; *I. Sloteri*. Cardinal Climber, Scarlet, CCrr/—RR; *I. Sloteri*, Hearts & Honey, Orange, light center, CCrr/—rr, derived as a segregate from Cardinal Climber. This indicates enough homology of chromosomes bearing genes r and R in the two parental species, to allow them to pair in the amphiploid hybrid.

3. A BIOSYSTEMATIC STUDY OF *Rosa Acicularis*.

Walter H. Lewis; *Blandy Experimental Farm, University of Virginia*.

Utilizing the evidence obtained from the disciplines of gross- and micro-morphology, cytology, and phytogeography, the population of *R. acicularis* are divisible into two; a Eurasian, octoploid (2n– 56) taxon as subsp. *acicularis* and a North American, hexaploid (2n – 42) taxon as subsp. *Sayi* (Schw.) Lewis. Individuals morphologically intermediate between these subspecies occur in eastern Siberia and Alaska, but only a critical cytological examination of plants from this region can determine the authenticity of their hybrid origin. No native septaploid (2n – 49) plant is now known although such an individual has been obtained from a controlled cross giving a new polyploid number to the genus *Rosa*.

4. THE EFFECT OF INDOLEACETIC ACID ON CERTAIN GROWTH PHASES OF MOSSES.

Paul M. Patterson; *Hollins College*.

The literature on growth promoting substances as it pertains to the bryophytes was reviewed. Concentrations of IAA varying from 1.0–0.01 gamma/cc were used since the optima for growth stimulation reported in the literature generally lay in this range. Spore germination and protonemal growth of several mosses were accelerated at the lower concentrations while others showed little or no response. Concentrations as high as 1.0 gamma/cc were inhibitory in most instances. Pseudopodia of Sphagnum bearing nearly mature sporophytes elongated quickly at the lower concentrations. The effect on the protonemal production from the gemmae of several species was indifferent or inhibitory.

5. WEEKLY FLUCTUATION OF AN UNSTABLE BEACH.

K. A. Wagner; *College of William and Mary* in Norfolk and W. W. McNeil; *Seashore State Park*.

The weekly gain or loss of sand on a beach segment may exceed two feet even under conditions not considered severe storm. These fluc-

tuations may be correlated with actual tide levels and, indirectly with those conditions which affect deviation of the tides from the predicted levels.

6. PHOSPHORUS AS A NUTRIENT IN MARINE WATER.[1]

Kathryn Page Smith; *Newport News High School.*

The amount of phosphate-phosphorus used in the cycle of growth of *Chlorella* was studied. Samples of water were taken from the York River, the James River, Old Point Comfort, and Hampton Roads. After one gram of 6-8-6 fertilizer was added to each liter of water, the solutions were set in a warm place with much sunlight. In about a month the cultures were green with *Chlorella*. When these solutions were growing well, tests were made at intervals for the total phosphate-phosphorus content and the inorganic phosphate-phosphorus content, with the organic content in the *Chlorella* being found by substracting the inorganic result from the total value. Variations of certain colorimetry tests were used for the determinations. Because of certain factors the results of these tests were not too accurate, giving at best only good estimates of how much phosphorus the *Chlorella* used as it grew. A cycle for the use of the phosphorus could not be found as the *Chlorella* took so long to begin to grow well. However, it was discovered that when the weather was good and the *Chlorella* showed good growth, its organic phosphorus content increased while the inorganic content in the water decreased. When there was less sunlight for photosynthesis, the *Chlorella* grew little, with its organic content decreasing and the inorganic phosphorus content increasing.

7. PRESERVATION OF PLANT MATERIALS FOR COLLECTION.[1]

Mary Virginia Charlton; *Buckingham Central High School.*

The methods of preservation of plant material for collection were studied. Methods studied were: (1) embedding with wax, plastic, or resin; (2) dehydrating by pressing, hanging, using borax, or baking; (3) pickling with alcohol or formaldehyde; (4) wax or glycerin replacement; (5) coating by dipping fresh material in wax, plastic, or varnish; and (6) finishes for dehydrated material.

This study shows that all plant material can be preserved, but not in the same way. The method to be used depends upon the moisture content, the structure, and the thickness of the material. All materials should be gathered at maturity. Picked material is useful, but it tends

[1] Honorable Mention, National Science Talent Search.

to finish its life cycle, contains moisture, and insects and microbes attack it.

Study tends to show that leaves and roots are most adaptable to pressing; stems, buds, and seed pods, to hanging; flowers to hanging, wax dipping, boraxing, plastic mounting, and resin mounting. Plastic applied to dehydrated material is most advisable.

8. UNIT AND POLYGENIC TRAITS AS INDICATORS OF POPULATION RELATIONSHIP.[1]

B. L. Hanna and Mary Ellen Dechert; *Medical College of Virginia.*

The biological relationships among seven Athapascan, Piman and Yuman Indian tribes of the southwestern United States are examined with respect to the distributions of (1) quantitative anthropometric measurements, each presumably affected by the interaction of several or many gene systems and (2) allelic frequencies at the ABO blood group and the MN and Rh blood type loci, each of which is genetically independent of the others. The results of analyses of the quantitative traits by the D^2 method of Mahalanobis suggest that the linguistic groups represent biological units, each exhibiting a different degree of internal variation. The distribution of biological distances among the tribes may be explained on the basis of known tribal histories. Study of the blood groups and types reveals the same general relationships, with coefficients of divergence related to the mileage distance between population centers. The examination of several loci is shown to give a more reliable estimate of biological relationship than examination of single loci. It is suggested that fixation at the ABO locus among the small Maricopa population has resulted from random frequency fluctuation. The results do not support Birdsell's contention that polygenic traits are no more stable in time than are unit traits.

9. THE SEX BIVALENT OF THE CHINESE HAMSTER, *Cricetulus Griseus.*

Ladley Husted, Edward G. Pollock, and Grover C. Smart, Jr.; *University of Virginia.*

The Chinese hamster, *Cricetulus griseus*, has 22 chromosomes. The sex chromosomes are the third largest pair at late prophase and prometaphase of spermatogonial divisions. As the chromosomes decrease in length they become the fourth largest pair and at late metaphase cannot be distinguished by size alone from the smaller of the large submedianly constricted pairs. The short arm of the Y is shorter than the

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[1] Aided by a grant from the A. D. Williams Fund of the Medical College of Virginia.

short arm of the X. The difference represents 6-10 pecrent of the length of the X-chromosome. In the male the X and Y are found as rod-, and less frequently as ring-bivalents. All the rod-bivalents are associated by their shorter, heteromorphic arms.

10. SOME NOTES ON MALEIC HYDRAZIDE.

Arthur L. Eiser, Jr.; *Virginia Polytechnic Institute.*

Maleic hydrazide, a relatively new chemical, possesses selective herbicidal and plant growth inhibitor qualities. Sprayed on plants it is absorbed and moves internally to block the growth-promoting hormone present in plants.

Solutions containing 1.0, 0.5, 0.25, 0.125, and 0.0625 percent maleic hydrazide were used in the study of the spray in retarding the growth of some ornamental plants. Plants of *Coleus blumei* and *Thuja occidentalis*, and *Ilex crenata* were used in the experiment. The 0.25 percent solution gave most satisfactory results in retarding growth of *Coleus* and *Thuja* plants without serious damage. A 0.0625 percent solution showed the most favorable result on the *Ilex* plants.

Workers have found that maturity of plants and the manner of application of the chemical affect the results. This experiment indicated that results are also affected by: (1) the degree of activity of the plant tissue; (2) the concentration of the material used; and (3) the genotype.

11. OBSERVATIONS ON THE FRESH-WATER MEDUSA, *Craspedacusta sowerbii*, OCCURRING IN A POND IN SOUTHAMPTON QUARRY.

Nolan E. Rice; *University of Richmond.*

A total of forty-seven specimens of the fresh-water medusa were collected in a pond in Southampton Quarry, Richmond, Virginia on July 22 and August 4, 1954. Fertilized eggs developed to the hydroid stage. Approximately equal numbers of both sexes were present in the collections. No medusae were found during the summer of 1955. Collections made between June 15 and September 30, 1956 totalled 35 males and 544 females, but no males appeared in collections between August 16 and 28. The absence of males in the pond was indicated also by the fact that 165 females failed to produce fertilized eggs. Of a total of 515 specimens (including immature ones), 134 had fed on daphnias, one on nematodes, 3 on amphipods, and 7 on unidentified organisms. The coelenterons of the remainder were empty. Hydroids have been cultured for nine months. Several species of rotifers served as food. Out of over a hundred reports of the occurrence of the medusa since its discovery in 1880, this is the second instance of the occurrence of both sexes together in the same body of water.

12. THE HOST-SPECIFICITY OF MONOGENETIC TREMATODES.

William J. Hargis, Jr.; *Virginia Fisheries Laboratory.*

Members of the order Monogenea are highly host-specific. Many authors have discussed this phenomenon during the last half-century. Recent tabulations confirm their conclusions.

The data undergirding this discussion were collected at Westhampton Lake, University of Richmond and the Alligator Harbor Marine Laboratory of Florida State University. A study of these data disclosed two general aspects of monogeneid host-specificity. *Infra-specificity* is the occurrence of a single monogeneid species on members of a single fish taxon. If the parasite is on one species the term species-specificity applies, if on several congeneric species – genus-specificity, *etc.* Marine monogeneids seem more infraspecific than fresh-water forms although the latter strongly exhibit this phenomenon. Supraspecificity is the occurrence of members of a supraspecific parasite taxon on members of a fish group.

Both infraspecificity and supraspecificity have phylogenetic and/or ecological implications. Studies of host-specificity may aid in understanding the natural relationships of hosts and *vice versa.* The Monogenea offer a sound basis for studies of this fundamental aspect of parasitism.

13. THE DISTRIBUTION OF *Neoechinorhynchus cylindratus* VAN CLEAVE IN NORTH AMERICA.

Harry L. Holloway; *Roanoke College.*

In the life cycle of this parasite three distinct groups of animals are involved as potential hosts: fishes, arthropods, and fish-eating mammals. Of these, fishes and arthropods are essential links in the life cycle; and fish-eating mammals appear to be accidental. Ward (1940) found the largemouth bass (*Micropterus salmoides* Lacepede) to be the natural definitive host, the bluegill (*Lepomis pallidus*) a transport host, and an ostracod (*Cypria globula* Furtos), the first intermediate host.

The long list of piscine vertebrates (28 species) reported as definitive hosts for *N. cylindratus* indicates a wide range of physiological adaptation between this parasite and its hosts. A study of Westhampton Lake fishes revealed that this parasite finds optimal conditions in a relatively small number of fishes.

N. cylindratus has been reported from nine states (eight east of the Mississippi and Minnesota) and the Canadian province of Ontario. The lack of records to the west of the Mississippi may be due to the lack of field studies. The fish hosts and probably *C. globula* are much

more widely distributed than *N. cylindratus*. The factors responsible for *N. cylindratus* failing to attain the geographical limits set by its hosts cannot be explained at this time.

14. CHAETONOTID GASTROTRICHA IN ASHLAND, VIRGINIA.

C. E. Packard; *Randolph-Macon College*.

Chaetonotus succinctus (Voigt) and *Polymerurus nodicaudus* (Voigt), or closely related variants thereof, have been found in campus waterpools and are reported for the first time from Virginia. Morphological and other data concerning these lesser known chaetonotids were presented.

15. ALKALINE PHOSPHATASE IN TURBELLARIA.

Paul J. Osborne; *Lynchburg College*.

The histochemical technique of Gomori for the localization of alkaline phosphatases was applied to five species representing three orders of Turbellaria. Evidence of the enzyme was found in certain tissues of all the worms tested. The state of nutrition appeared to affect the distribution of enzyme activity, as was found in controlled studies on two species of aquatic triclads. Several physiological roles are suggested for alkaline phosphatases in the life of these worms.

16. THE LIFE HISTORY OF THE LESSER PEACH TREE BORER IN VIRGINIA.

Marvin L. Bobb; *Virginia Agricultural Experiment Station*.

The lesser peach tree borer, *Synanthedon pectipes* G. & R., has caused considerable injury to peach trees in eastern Virginia during the past few years, and the pest is becoming more numerous in peach orchards throughout the state. The female moth prefers to oviposit eggs in broken bark, and the borers get started most often in split limbs and crotches, in pruning scars, in abrasions caused by equipment, in cankers and sunscald, and in winter-injured areas.

The winter is passed in various stages of larval development under the bark and in old feeding galleries. The larvae feed on the inner bark and cambium layers throughout the summer. Two distinct generations developed during 1956. Moth emergence extended over a period from mid-April to mid-November, with an overlapping of the two broods in July.

17. THE CHEMICAL SENSES OF ARTHROPODS.

E. S. Hodgson; *Columbia University* and *Mountain Lake Biological Station*.

The senses of taste and smell are among the principal senses of

arthropods. By recording the electrical changes which accompany the functions of these receptor cells, precise information about their physiology is being collected. In some cases, the behavior of an insect can be predicted from measurements of the responses of its chemoreceptors. The chemoreceptors of various insects and crayfish exhibit different ranges of sensitivity related to the diet of the species. The receptors of arthropods commonly respond to more than one type of stimulus (chemicals, temperature changes, touch, etc.), contrary to the theory of "specific nerve energies." Many insecticides, attractants, and repellents exert their primary action on such receptors. A tape recording of the nerve impulses from chemoreceptors will be used to illustrate some of their properties.

18. COMPARATIVE OSTEOLOGY OF SERRANID FISHES OF THE GENUS *Roccus* (Mitchill).

William S. Woolcott: *University of Richmond.*

The genus *Roccus* is represented by six species and three sub-genera. In North America the subgenus *Roccus* (Mitchill) contains *saxatilis* (Walbaum) and *chrysops* (Rafinesque); the subgenus *Morone* (Mitchill) includes *americanus* (Gmelin) and *interruptus* (Gill). In Europe two species, *labrax* (Linnaeus) and *punctatus* (Bloch), form the subgenus *Dicentrarchus* (Gill). Formerly the species were assigned to as many as five genera by authors. Jordan and Gilbert (1883, Synopsis of the Fishes of North America) relegated the four American species to the genus *Roccus* and tentatively included the two European species. Berg (1949, Fresh-water Fishes of the USSR and Adjoining Countries) assigned the six species to the genus *Morone* with three subgenera. Both classifications were based primarily on external characters. The present osteological study, undertaken to check the validity of a monogeneric classification, compared five species (*punctatus* expected). Preserved specimens were X-rayed, cleared and stained while others were cleaned by insects. Greatest species differences were found in the supraoccipital crest, otic (prootic, basioccipital and exoccipital), vomerine tooth plate and preopercle. However, these differences as well as those of smaller magnitude had intermediate forms between the extremes. Except for *americanus* and *interruptus* the species were readily separated using osteological characters. The findings strongly support a monogeneric classification, but both osteological and external characters are needed to properly define subgenera.

19. THE EFFECTS OF POLLUTION ON VIRGINIA'S MARINE FISHERIES.

J. L. McHugh; *Virginia Fisheries Laboratory.*

Virginia has important commercial and recreational fisheries and many of the animals in them spend an important part of their lives in

the estuaries, where they are vulnerable to the effects of industrial wastes. Particularly threatened are the oyster, which spends its entire life in the estuary, the shad, striped bass, and other anadromous fishes, which enter fresh water to spawn and utilize the tidal estuaries as nursery grounds for a considerable period after hatching, and migratory animals like the blue crab, croaker, menhaden, and spot, that spend several months of their first year of life in the estuaries.

Because we know almost nothing of the effects of specific components of industrial wastes upon these estuarine organisms, we are ill-prepared to forecast the possible consequences of increased industrialization of the tidewater area. We cannot even state what maximum concentrations of the various wastes should be permitted in natural waters, hence cannot advise as to the levels of waste treatment that should be required. Virginia cannot lag behind in industrial development and maintain a balanced economic status, yet without adequate information for planning precautionary measures, the growth of industry might affect our marine resources seriously.

Several major pollution problems already exist in the James, York, and Rappahannock Rivers. Other situations exist in these same waters which pose an equal threat to the seafood industry, yet are entirely natural in origin. Such a situation in the Rappahannock River caused serious oyster mortalities in 1949 and 1955, yet most oystermen blamed pollution from the Fredericksburg area. Badly needed are funds and personnel to conduct basic studies of all phases of estuarine ecology, together with experimental investigations of the effects of specific physical and chemical factors, and specific components of industrial and domestic wastes, on the important marine organisms. Joint financial support by industry and by the State would seem appropriate.

20. BLOOD OXYGEN CAPACITY OF ALBINO RATS.

Jack D. Burke; *University of Richmond.*

The microgasometric syringe method was used to determine the blood oxygen capacity of 64 albino *Rattus norvegicus* (Sherman strain). Data were obtained showing the relationship of blood oxygen capacity to weight and sex of the animals. It was found that blood oxygen capacity in volumes per cent increased as the weight of the rats increased. Also, the oxygen capacity of the blood per unit of body weight decreased as the weight of the rats increased. Statistically, there was no difference in the blood values in either male or female rats as analyzed in different weight groups and ranges.

21. MILIEU AND THE MANNER OF MELANOCYTES.[1]

Willie M. Reams, Jr.; *Medical College of Virginia.*

Cultivation *in vitro* of coelomic melanocytes alone and in combination with different types of tissues indicate that there is an antagonism between certain embryonic tissues and the coelomic lining for the mode of expression of pigment cells. That is, the tissue community of the coelomic lining acts as an inhibitor upon the formation of branches by the pigment cells, whereas effective branching is evoked in the presence of certain other embryonic tissues. The evidence demonstrates a dosage effect to be in play. In order for a pigment cell to produce branches, the titre of the effector substance must be sufficiently high to off-set the inhibitory effects imposed by the coelomic lining. That the principal factor which initiates the production of branches by the pigment cells appears to be a chemical entity and not merely a matter of physical substrate influences was shown by the application of extract from embryonic skin upon cultures of coelomic lining melanocytes. Such a procedure resulted in the formation of branches by the previously unbranched cells.

22. BLOOD OXYGEN CAPACITY IN TURTLES.

Harold J. Payne; *University of Richmond.*

The blood oxygen capacity of 80 turtles was determined by the Grant modification of the Roughton-Scholander microgasometric syringe method. These animals were collected in two different habitats. Forty specimens represent the aquatic type (*Chrysemys picta*), and 40 specimens represent the terrestrial type (*Terrapene carolina*). Data were obtained which showed a relationship of oxygen capacity to body weight in each species. It was found that in the aquatic animals, the oxygen capacity in volumes per cent per gram of body weight decreased as the body weight increases. The same trend of relationship was found to exist in the terrestrial turtles. Statistically, there is an indication that no difference existed in the mean blood oxygen capacities in relation to the body weight of the two forms. Also, there was no statistical evidence of sexual dimorphism of the turtle blood oxygen capacity in relation to body weight in each species.

23. A COMPARISON OF THE BLOOD OXYGEN CAPACITY IN THE BLACK CRAPPE (*Pomoxis nigromaculatus*) AND THE BLUEGILL (*Lepomis macrochirus*).

Jack D. Burke and William S. Woolcott; *University of Richmond.*

The blood oxygen capacity in twenty specimens of black crappie

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[1] Supported in part by a grant from the A. D. Williams Fund of the Medical College of

(*Pomoxis nigromaculatus*) and twenty specimens of bluegill (*Lepomis macrochirus*) was determined by the Roughton-Scholander microgasometric syringe method. The black crappie and the bluegill had a mean body weight of 71 and 86 gm., a mean standard length of 132 and 133 mm., and a mean blood oxygen capacity of 8.5 and 7.4 volumes per cent respectively. Statistically, a significant difference existed between the blood oxygen capacities of the two species. Total blood oxygen capacity increased with an increase in body weight. However, as the body weight increased, the oxygen capacity of the blood per gram of body weight decreased. There was no indication of sexual dimorphism for this character. It was also found that the blood coagulated in 30 seconds or less in each species.

24. THE ROLE OF MAN IN DISTRIBUTING DISEASES AND PESTS OF MARINE ORGANISMS.

Jay D. Andrews; *Virginia Fisheries Laboratory.*

Man has a penchant for taking plants and animals with him in his migrations with little consideration for the well being of the immigrant or native species which must live together. Man's introduction of domestic species has been beneficial on the whole although numerous pests and diseases have accompanied these transplantings and challenge the ingenuity of scientists. The introduction of wild species has been more haphazard, and, in the writer's opinion, more deleterious than helpful.

Nowhere are the effects of introductions more clearly demonstrated than in marine waters where man's control of populations of organisms is quite limited. The literature on oysters abounds with accounts of "plagues" some of which have been traced to earlier introductions. Probably more pests and diseases of oysters remain unknown than are presently recognized. The "enemies" of marine fishes and invertebrates have been scarcely touched upon. No doubt man's inexorable and unwitting goal for each species is a distribution as cosmopolitan as its vitality will permit. This is competition and survival of the fittest at an accelerated and unnatural pace; indubitably many species will fall by the wayside — in numbers if not *in toto*.

25. THE PEA CRAB *Pinnotheres Ostreum* AS A PARASITE OF THE OYSTER.

Dexter S. Haven; *Virginia Fisheries Laboratory.*

The pea crab *Pinnotheres ostreum*, as a parasite in the mantle cavity of the oyster *Crassostrea virginica*, ranges from Massachusetts to Florida. In Virginia it is present in oysters living in waters of moderate and high salinities. The incidence of this parasite varies with the age of

oysters, season, year, salinity, and other factors. Pea crabs impair the growth and fattening of oysters by scraping food from the gills which are usually injured in the process. In the York River, oysters with pea crabs yielded from 17 to 33% less meat on a wet-weight basis than oysters free of this parasite. Infected oysters were smaller than those without crabs as shown by measurements of shell length, total volume, and capacity of the shell cavity.

26. CHROMOSOMES OF POGONIA AND OF ITS ALLIES IN THE RANGE OF GRAY'S MANUAL.

J. T. Baldwin, Jr., and Bernice M. Speese; *College of William and Mary.*

Pogonia ophioglossoides, Isotria verticillata, I. medeoloides, and *Cleistes divaricata* each has a 2n-number of 18; the chromosomes are large. Morphological differences between the idiograms of the two species of *Isotria* appear as great as the differences among the idiograms of *Pogonia, Isotria,* and *Cleistes.* This may be used as evidence for the maintenance of all these plants in *Pogonia. Triphora trianthophora* has 44 small chromosomes. This marked difference in chromosome number and size of chromosomes support the conclusion of Oakes Ames that *Triphora* is not closely allied to the *Pogonia* complex. Observations on fluctuations in populations of the two species of *Isotria* at a single station in Virginia over a period of 36 years are recorded.

27. *Phoradendron flavescenss* CHROMOSOMES, SEEDLINGS, AND HOSTS.

J. T. Baldwin, Jr., and Bernice M. Speese, *College of William and Mary.*

Twenty-six collections of Virginia representatives of *Phoradendron flavescens* and one Arkansas collection have been examined cytologically; the mistletoes were from 15 taxa of hosts. Chromosome number for the species is uniform; 2n=28; n=14. Chromosome morphology is constant for pistillate and staminate plants, for plants from Virginia and Arkansas, and for plants from different hosts (with the possible exception of certain individuals on *Carya*). Mitotic metaphase chromosomes contracted with paradichlorobenzene for 24 hr. range in length from 5.7μ to 12.8μ. Meiosis occurs during July and August. Chromosome numbers and sex-chromosome mechanism reported by Billings for two species of *Phoradendron* are considered likely to be based on faulty observations. Seedlings of *P. flavescens* offer many possibilities for experimental work. The hypocotylar axis seemingly exhibits no regular geotropic response unless it be negative. The tip of the axis apparently contains a digestive enzyme. Some seed are polyembryonic. Genetic races of *P. flavescens* with respect to host preference seem to exist.

28. A STUDY OF TULAREMIA IN A NATIVE POPULATION OF WILD RABBITS IN AN ENCLOSURE.

Burd S. McGinnes; *Virginia Polytechnic Institute.*

Tularemia (*Pasteurella tularensis*) was discovered in a 10.9 acre rabbit enclosure near Roanoke in October, 1956. Cottontails indigenous to the enclosure were live-trapped and marked, using 45 traps during 22 nights. During the three week period, 14 rabbits were captured and marked, however, eight or 57 percent plus three unmarked specimens were found dead within 25 days. Enclosure drives revealed an additional 12 rabbits remains, dead 3 to 12 weeks. Early in November, 19 marked rabbits were released. Within 31 days, 46 per cent of the stocked rabbits were found dead. From March, 1957 release of 9 cottontails, four disease victims were retrieved; these 44 per cent succumbed within 39 days post-release. All rabbits autopsied displayed necrotic foci on the liver and spleen. The disease appeared to be restricted to cottontails. Liver-suspension injections killed domestic rabbits from which the tularemia organism was isolated. Disease activity subsided with the onset of winter weather, but became virile to rabbits again in the spring of 1957. The data indicated that the presence of tularemia may make impractical, from a game management point of view, both the reestablishment or building up of a satisfactory population on an infected area.

29. MEGASPOROGENESIS AND MEGAGAMETOGENESIS IN *Polygala polygama*.

John H. Reeves, Jr.; *Virginia Polytechnic Institute.*

In an effort to add more information to the study of phylogenetic relationships of plants, a study of megasporogenesis and megagametogenesis in *Polygala polygama* were done.

Polygala polygama possesses both chasmogamous (aerial, open flowers) and cleistogamous flowers.

It was discovered that the development of the embryo sac of *Polygala polygama* followed the general *Polygonum* type (monosporic — eight nucleate type). All stages of embryo sac development in both types of flowers are alike, except that the cleistogamous flower produces a larger embryo sac than does the chasmogamous flower.

30. BLACK BEAR CUB GROWTH STUDY AND ITS IMPLICATIONS IN MANAGEMENT.

Allen R. Stickley, Jr.; *Virginia Polytechnic Institute.*

Three black bear cubs (*Euarctos a. americanus* Pallas) were hand-reared and studied in 1956 by the Virginia Wildlife Research Unit for the purpose of gathering data which might prove useful in bear manage-

ment. Tooth eruption and weight data obtained were considered to be of the most value. Cub A, the male, grew much faster than either B or C, the two females; and all three cubs were considered unusually large for their age. This condition was believed to be caused by the abundance of food available in their captive status. Considerable individual variation was found in the eruption dates of the permanent dentition, but all the cubs had their full set of adult teeth by one year of age. The chronology of tooth eruption in the black bear was compared to that of the European Brown bear (*Ursus arctos*) and was found to extend over a period of time only half that of the brown bear. However, the order of eruption was quite similar. On the basis of this cub study, it is believed that Virginia's law which prohibits shooting any bear under 75 lb. offers adequate protection for black bear cubs.

MINUTES OF THE SECTION OF CHEMISTRY (5)

MARY E. KAPP, *Chairman*

JOSEPH C. HOLMES, *Secretary*

CARL J. LIKES, *Section Editor* (1957)

FRIDAY, MAY 10, 1957 – 9:00 A.M. – JOHN SMITH ROOM

Concurrent Session In Chesapeake Room

1. SOME EXPERIMENTS USING PHENYL ACID PHOSPHATE AS A CYCLIZING AGENT.

F. A. Vingiello, M. Spangler, W. Zajac, R. Thornton, R. Stevens, M. Schlechter and R. Light; *Virginia Polytechnic Institute.*

The possibility of finding new catalysts for the aromatic cyclodehydration of ketones was studied. Recently F. A. Vingiello and A. Borkovec, (J. Am. Chem. Soc., 78, 3205 (1956) reported on the use of alumina as such a catalyst. The use of phenyl acid phosphate (kindly supplied to us by the Virginia-Carolina Chemical Company) as a cyclizing agent has been investigated.

Various aromatic ketones were synthesized and cyclized to give substituted anthracenes and benzanthracenes using phenyl acid phosphate as a catalyst. The syntheses of the ketones as well as the cyclization experiments were described.

2. AN UNEQUIVOCAL SYNTHESIS OF 3– CHLORO – 9 – ANTHRONE.

F. A. Vingiello, P. Newallis and M. Schlechter; *Virginia Polytechnic Institute.*

On reduction of 2-chloroanthraquinone with tin and glacial acetic acid, Barnett and Mathews [J. Chem. Soc., 2549 (1923)] isolated a pure compound, m.p. 156° which they designated at 2 (or 3) – chloro – 9 – anthrone (I). Several years later, Barnett and Wiltshire [J. Chem. Soc., 1822 (1928)] unequivocally prepared 2– chloro – 9 – anthrone (II), m.p. 155°. Since a mixed melting point of I with II showed a depression, it was concluded that I was 3–chloro – 9 – anthrone. In addition, an admixture of the acetates of I and II showed a depression in melting point.

In connection with work on the synthesis of certain DDT analogues 2–bromo – 5 – chlorodiphenylmethane was prepared. This was converted to the Grignard reagent, carbonated and the resulting 2–benzyl – 4 – chlorobenzoic acid was cyclized with sulfuric acid to give 3–chloro – 9 – anthrone. This was converted to its acetate using acetic anhydride in pyridine. The results obtained are tenable with those of Barnett and his co-workers.

3. SOME IONIC ADDITION REACTIONS OF TWO ISOMERIC 3–METHYLDIHYDROTHIOPHENE 1,1–DIOXIDES.

Robert C. Krug and Francois E. Didot; *Virginia Polytechnic Institute.*

The action of 5% aqueous potassium hydroxide on 3–methyl–2, 5–dihydrothiophene 1,1–dioxide (β–isoprene sulfone) gave the isomeric, 4–methyl–2,3–dihydrothiophene 1,1–dioxide (α–isoprene sulfone) in 70% yield. The addition of hydrogen bromide to the α– and β–isoprene sulfones was accomplished by passing hydrogen bromide through an aqueous solution containing zinc bromide. A yield of 55% was obtained in both cases, giving the same end product, the 3–bromo–3–methyl tetrahydrothiophene 1,1–dioxide.

In a similar manner hydrogen chloride was added to the β–isoprene sulfone in 35% yield. No evidence for the addition of hydrogen chloride to the α–isoprene sulfone was obtained.

4. MOLECULAR WEIGHT DETERMINATIONS FROM EFFUSION CONSTANTS.

Charles J. Varsel, John P. Bell, Joseph C. Holmes, and Frank E. Resnik; *Philip Morris Incorporated.*

The application of mass spectrometry to qualitative analysis is limited in certain instances because of the lack of molecular ion peaks and spectrum complexity in the case of mixtures. For these reasons new techniques were sought which were capable of producing additional information about the components of a mixture. One technique investigated was the effusion rates of gases. The mass spectrometer, with its capillary leak and ionization source, is an excellent effusiometer which can be used for determining the effusion rate of any volatile compound.

According to Graham's law, "the effusion rate of a gas is inversely proportional to the square root of its molecular weight." Therefore, the molecular weight of any volatile compound can be calculated by comparing its effusion constant with that of a reference gas.

The rate of partial pressure decline of a compound is measured in the mass spectrometer and the molecular weight calculated by compari-

son with a standard sample whose effusion constant and molecular weight are known. A number of organic compounds were investigated, through this technique and the accuracy of the molecular weight measurements were within +3% of their known values.

Although this paper presents data obtained from mass spectrometric studies, any apparatus can be used in which the rate of effusion of a gas through a capillary leak can be measured.

5. THE CLARIFICATION OF AQUEOUS TOBACCO EXTRACTS PRIOR TO DETERMINING REDUCING SUGARS.

F. L. Greene and Robert B. Seligman; *Philip Morris Incorporated.*

Prior to the determination of its total reducing sugars, aqueous tobacco extracts must be clarified. Ordinarily, neutral lead acetate solutions are used to precipitate the non-sugar, reducing substances in such extracts.

The use of charcoal absorption chromatography for clarification was described and its effectiveness compared with that of the clarification done with lead acetate.

Comparisons were made of (1) the efficiency of the clarification, (2) the effect on the final total reducing sugar values, and (3) the total time of sample preparation.

This is an initial report. The experimental details of the procedure were given, and the results obtained from a limited number of samples were presented.

6. MICRO INFRARED TECHNIQUES FOR THE IDENTIFICATION OF CARBOHYDRATES.

F. E. Resnik, L. S. Harrow, J. C. Holmes, M. E. Bill and F. L. Greene; *Philip Morris Incorporated.*

The extractable portions of most natural products are complex. For this reason characterization techniques of high selectivity and sensitivity must be employed in determining the composition of these mixtures.

Infrared spectroscopy has been used extensively for the specific identification of compounds from natural products. This method of characterization, however, has always been limited by the difficulties of examining water soluble substances and microgram quantities of materials. Techniques were described by which microgram amounts of water soluble compounds, particularly carbohydrates, can be identified and determined by infrared spectroscopy. The scope and limitations of these

techniques were discussed and typical spectra were presented. The specificity of infrared speetroscopy for carbohydrate identification was emphasized and the spectra of structurally similar carbohydrates were presented and discussed.

These techniques were applied to the identification of carbohydrates in tobacco.

7. STUDIES OF TOBACCO LEAF PROTEINS.

Donald F. Koenig, James K. Palmer, and Carl J. Likes; *Johns Hopkins Hospital* and *Virginia Institute for Scientific Research.*

The importance of the proteins in the curing and aging of tobacco leaf as well as in the metabolism of the living plant has been amply demonstrated. The purpose of this investigation was to characterize a protein fraction – Fraction I – which appears to be homogeneous and constitutes approximately 40% of the total protein of the green tobacco leaf. This protein fraction is of special interest as it disappears from the leaf during curing.

The leaf proteins have been extracted from fresh, frozen and lyophilized leaf tissue with various buffers. Ultracentrifugation of these extracts reveals the presence of Fraction I and serves as a means of estimating the relative quantity present. Factors affecting the yield of Fraction I from the leaf have been studied.

Fraction I has been isolated essentially free of other contaminants by ultracentrifugation across a density gradient boundary. The isolated protein has been characterized by its sedimentation constant, amino acid composition and other properties.

8. DISTRIBUTION OF RADIOACTIVITY IN MAIN AND SIDE STREAM CIGARETTE SMOKE USING CARBON-14 LABELED MATERIALS.

P. M. Pedersen and E. S. Harlow; *Research Laboratory, The American Tobacco Company.*

Using carbon-14 tracer techniques, the distribution of activity was determined in certain fractions of the main and side stream smoke of cigarettes in which had been incorporated carbon-14 randomly labeled materials. The radioactive materials used included tobacco itself, glucose, nicotine, cellulose, glycerol, a pentane extract of labeled tobacco and a chloroform extract of labeled tobacco. Cigarettes were smoked under controlled conditions and both main and side stream smoke were collected in appropriate absorption trains. The activities of gross fractions, including the particulate phase, carbon dioxide, carbon monoxide, aldehydes and other gases, were determined by means of a gas-flow counter, using

a technique developed at the University of Chicago by Dr. W. F. Libby. This involves the mixing of the active materials with talc and subsequent counting.

9. THE RESPIRATION OF THE TOBACCO PLANT. I. OXIDATION OF HEXOSE PHOSPHATE AND PENTOSE PHOSPHATE BY CELL-FREE EXTRACTS OF TOBACCO LEAVES.

R. A. Clayton; *Research Laboratory, The American Tobacco Company.*

In this study, an attempt was made to elucidate the pathway(s) of carbohydrate metabolism operative in the leaves of *Nicotiana tabacum*. Acetone powders of leaves of field-grown Bright tobacco, prepared in the usual manner, were homogenized with O.1 M. Tris buffer (pH 7.60) containing cysteine. In the absence of cysteine, the homogenate darkened rapidly and lost activity. After centrifugation at 8500 x G., the clear yellow supernatant was used to study TPN reduction and oxygen uptake.

The rate of reduction of TPN was followed spectrophotometrically at 340 mu. The following substrates, listed in order of decreasing activity, reduced TPN: glucose-6-phosphate, fructose-6-phosphate, hexose-diphosphate, 6-phosphogluconate, ribose-5-phosphate and glucose -1-phosphate. None of the substrates reduced DPN or DPN in the presence of arsenate. With HDP as substrate, TPN reduction was inhibited *ca.* 25% by iodoacetate, while fluoride induced a slight lag in the reduction.

When oxygen uptake was followed with the substrates listed above, the homogenates were active without the addition of any cofactors except TPN, DPN or DPN plus arsenate did not replace TPN. With some homogenates, no oxygen uptake activity was observed with HDP, even though these homogenates showed good TPN reduction with this substrate.

Cofactor requirements of dialyzed extracts, inhibitor studies and a comparison of activity with stalk position were discussed.

10. SPECTROPHOTOMETRIC DETERMINATION OF TOTAL CARBONYL CONTENT UTILIZING INTEGRATED ABSORBANCE MEASUREMENTS.

L. S. Harrow, J. T. Butler, F. E. Resnik, A. C. Estes, and R. B. Seligman; *Philip Morris Incorporated.*

Previous communications from this laboratory have shown the utility of the absorption spectra of 2,4-dinitrophenylhydrazine carbonyl derivatives for the characterization of individual carbonyl compounds. A method for the estimation of total mono- and di-carbonyl compounds was described. The method involves formation of a mixture of 2,4-dinitrophenylhydrazones by reaction of 2,4-dinitrophenylhydrazine with the sample fol-

lowed by separation into mono- and di-hydrazone fractions. After suitable purification, alkaline solutions of the two fractions are examined spectrophotometrically in the visible spectral region. The integrated absorbances within defined wave length limits were found to be linear functions of the mono- and di-carbonyl contents of the original sample.

11. SPECTROCHEMICAL DETERMINATION OF CERTAIN TRACE METALS IN HUMAN BLOOD.

Leonel M. Paixao; *Pratt Trace Analysis Laboratory, University of Virginia.*

A spectrochemical method for the determination of magnesium, chromium, nickel, copper and zinc in human blood has been developed. The technique used for the collection, digestion and analysis of the blood samples were discussed, and all data available to date were compared with values found in the literature. Methods used by other investigators for the determination of these metals in human tissues were also considered, as well as possibilities for future work on trace analysis of blood and plasma.

12. A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF CHROMIUM IN HUMAN BLOOD.

Dwight O. Miller; *Pratt Trace Analysis Laboratory, University of Virginia.*

The most sensitive organic analytical reagent available for chromium is α-diphenylcarbazide. The reagent reacts with dichromate ions ($Cr_2O_7^{-2}$) in dilute sulfuric acid solution to give a violet colored complex. The use of this reagent makes it necessary to oxidize the chromium to the dichromate state quantitatively. The excess of oxidizing agent must then be removed because of its action on the reagent. Ferric ions interfere and must be removed before developing the color reaction.

13. SIMULTANEOUS SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF COPPER, COBALT AND NICKEL WITH DITHIOOXAMIDE.

William D. Jacobs; *Pratt Trace Analysis Laboratory, University of Virginia.*

The dithiooxamide (rubeanic acid) complexes of copper, cobalt and nickel have been investigated as a possible method for the simultaneous determination of traces of the three ions. Factors affecting the stability of the three systems, such as pH, the use of a protective colloid, temperature, and the order of addition of reagents have been studied.

Mole ratios of the three metallo-organic complexes have been determined. The adherence of the three color-systems to Beer's law, the effect of foreign ions and the optimum conditions for the analytical use of the reagent were investigated.

14. A NEW COLORIMETRIC REAGENT FOR URANIUM.

H. Perry Holcomb; *Pratt Trace Analysis Laboratory, University of Virginia.*

3-(2-Arsonophenylazo)-4,5-dihydroxy-2,7-naphthalene-disulfonic acid (trisodium salt), forms a stable complex with the uranyl ion (UO_2^{+2}) giving an intense blue color. The reaction is specific for the uranyl ion and is highly sensitive. A method for the spectrophotometric determination of uranium is now being developed, as well as a study of interference by various ions. The absorbance characteristics of the reagent and its uranyl complex were presented.

15. STRUCTURAL ANALYSIS OF THE NAPHTHYLAMINE SULFONIC ACID-OSMATE COMPLEXES WITH APPLICATION TO THE DETERMINATION OF TRACE AMOUNTS OF OSMIUM.

Edgar L. Steele and John H. Yoe; *Pratt Trace Analysis Laboratory, University of Virginia.*

The naphthylamine sulfonic acid-osmate complexes were investigated to determine the effect of the number and position of the sulfonic acid group on the rate and extent of reaction between the osmate ion (Os VI) and the amine group.

By means of various mole-ratio, rate, temperature and pH studies, a steric and resonance effect was noted and a reaction mechanism postulated. Optimum conditions for the determination of trace amounts of osmium have been established.

16. THE DISSOCIATION PRESSURES OF THE TANTALUM SILICIDES.

Clifford E. Myers; *Lynchburg College,* and Alan W. Searcys; *University of California.*

The dissociation pressures of the tantalum silicides have been measured by the Knudsen effusion method. Phase modifications in the temperature ranges covered were established by quenching experiments and x-ray diffraction investigation. The heats of dissociation were combined with the heat of vaporization of silicon to obtain, for heats of formation per silicon atom at 298°K.:

$4.5TaSi_{0.22_2\pm0.03}$, −34.4 kcal.; Ta_2Si, −29.3 kcal.; $1.67TaSi_{0.60\pm0.08}$, −26.7 kcal.; and $1/2TaSi_2$, −11.6 kcal.

17. A MODIFICATION OF THE TURMERIC PAPER TEST FOR BORON.

W. Allan Powell, Emmett H. Poindexter, and James E. Hardcastle; *University of Richmond.*

Various modifications of the turmeric paper test have been used for the detection and determination of traces of boron for many years. In the present work the sensitivity of the test has been increased considerably by the use of oxalic acid in the reaction mixture. Also a thorough study has been made of the effect of variables on the test.

To test for boron the paper containing boron is sprayed with a turmeric solution and allowed to dry. The red color developed is compared with standards prepared in a similar manner. Acetone is a very suitable solvent for preparation of the spray solution. The solution should contain no water since water increases the time required for full development of color. At high humidity the color developed is less intense. The time required for development can be reduced and the effect of high humidity minimized by the use of a development temperature of 55°C.

The test should be especially useful for paper chromatographic and electrochromatographic work. It is very sensitive, the difference between 0.00 and 0.01 micrograms being detectable. The increase in intensity with increase in boron is linear up to 0.20 micrograms boron.

18. COMBUSTION OF CARBON DISULFIDE-AIR MIXTURES.

George J. Gibbs, Irving R. King, and Hartwell F. Calcote; *Experiment Incorporated.*

The anomalous behavior of carbon disulfide-air flames in flame studies has been recognized by numerous investigators both in this laboratory and elsewhere. Since this is one of the few fuels which contains no hydrogen, and since one of the important mechanisms proposed for flame propagation is associated with the diffusion of hydrogen atoms ahead of the flame front, an investigation of the effect of water vapor on such a fuel should be of value in better understanding the mechanism of flame propagation. Such an investigation has been undertaken at Experiment Incorporated. Preliminary measurements indicate that the burning velocity of carbon disulfide-air flames increases as the hydrogen content decreases. Minimum spark ignition energy and quenching distance decrease as the hydrogen content decreases. This is quite contrary to the effect of water vapor on most fuels.

From these results, it would appear that hydrogen is not important in the diffusion mechanism for carbon disulfide flames; the important transport property may be diffusion of some other species or simply the transfer of heat by thermal conduction. It is suggested that, in this particular flame, hydrogen probably acts as an inhibitor of a reaction chain.

19. MICROSCOPIC EXAMINATION OF INCANDESCENT SURFACES.

Claude P. Talley and Everett J. Nieuwenhuis; *Experiment Incorporated.*

A technique has been developed for observing microscopically the surface character of elemental boron rods at 1000°C and above. The method consists of illuminating the surface with short wavelength visible light and filtering out the longer wavelength visible light which radiates from the incandescent surface. Only the reflected light which is responsible for revealing surface character is allowed to reach the observer's eye or photographic film after passage through the microscope. In this manner still and motion photomicrographs have been obtained of elemental boron at incandescent temperatures oxidizing in air. This technique enables one to determine unambiguously the sequence of visible events taking place on the surface.

20. WHISKER GROWTH OF SILVER METAL. MECHANISM AND KINETICS.

Welby G. Courtney; *Chemical Construction Corporation.*

The crystal growth of silver metal whiskers and "ferns" occurring in the reduction of Ag (I) by Fe (II) from aqueous perchlorate solution was observed under the microscope. Whiskers grew to 1000 microns in length with parallel sides and widths usually between 0.4 and 1.5 microns. They frequently grew at well-defined angles to the previous direction and occasionally stopped growing abruptly, although nearby whiskers continued to grow. In fern growth, short spikes grew in a regular manner from one side of a main stem. Linear growth rates of whiskers were essentially independent of an estimated eight-fold variation in supersaturation, but the growth rate of a particular whisker could increase abruptly with time in apparently integral ratios. Whisker or fern growth is attributed to an axial screw dislocation which had, respectively, a perfect or twinned lattice orientation across the dislocation plane. The results support the Burton-Cabrera-Frank (dislocation) mechanism for crystal growth and suggest that close-packed surfaces at the solution-solid interface in the present system are atomically smooth. However, the results appear to be difficult to reconcile with the BCF treatments of the growth behavior or infinite crystal surfaces and the kinetics of the growth of dislocated surfaces. An alternate explanation was presented for the observed growth kinetics.

21. COPOLYMERIZATION OF VINYL CHLORIDE AND STYRENE.

Joseph Clema; *National Science Talent Search.*

22. PREPARATION OF DIPYRRYLMETHYLPYROCOLLS. CATALYTIC REDUCTION OF 3, 5, 4' – TRICARBETHOXY – 4,3', 5' – TRIMETHYLPYRROMETHENE.

Bryant Harrell; Alsoph H. Corwin; *The College of William and Mary* and *The Johns Hopkins University.*

The catalytic reduction of 3,5,4'-tricarbethoxy- 4,3',5'-trimethylpyrromethene gave two dimeric products. The products were formulated as *cis* and *trans* isomers of a dipyrrylmethylpyrocoll derivative. Similar dipyrrylmethylpyrocoll derivatives were synthesized by other routes and have proven to exhibit properties similar to those of the compounds resulting from the reduction. Explanations were offered for the tendencies of these compounds to retain water and alcohol.

23. ULTRACENTRIFUGAL STUDIES OF AGGREGATION OCCURRING IN ALKALINE ZEIN SOLUTIONS.

Carl J. Likes; Donald F. Koenig; *Virginia Institute for Scientific Research* and *The Johns Hopkins Hospital.*

With the aim of obtaining information relative to the behavior of commercial zein in solutions suitable for the production of textile fibers, ultracentrifugal studies have been conducted on spin solutions (15% zein with 2% NaOH on the protein basis) diluted to one per cent protein with 0.01 N NaOH. In contrast to its behavior in 80% by weight aqueous isopropanol, in which zein exhibits a single sedimentation peak (sedimentation constant, 1.69 S), two ultracentrifugal components were observed in diluted spin solutions, one of which (Fraction I) sediments about twenty times more rapidly than the other (Fraction II). A number of properties associated with the aggregated phase, Fraction I, were discussed. These included: rates of formation and degradation, relative concentration, the effects of temperature and aging, solvent stability, the nature of intermolecular forces, and the influence of a cross-linking agent. The aggregation tendency of other proteins, such as ardein, casein, gliadin, and soybean protein, were compared with that of zein under corresponding conditions.

24. SYNTHESIS AND PROPERTIES OF PYRIDYLALANINES.

Herbert McKennis, Jr. and Edward R. Bowman; *Medical College of Virginia.*

To provide pyridylalanines for biochemical studies, methods for the synthesis of the parent compound and derivatives have been explored. 3-Pyridinecarboxaldehyde was condensed with creatinine in the presence of acetic anhydride and sodium acetate in glacial acetic acid The resulting 4-3'-pyridylmethylene-5-acetylcreatinine, m.p. 235-237°, on reduction with

zinc dust and acetic acid gave 4-3'-pyridylmethylcreatinine, m.p. 275-279° in 80% yield. Upon treatment with strong barium hydroxide and heat this compound readily yielded N–methyl-β-3-pyridylalanine. The corresponding pyridylmethylhydantoin similarly and in contrast to published reports [Niemann, et. al., J. Am. Chem. Soc. 64 1678 (1942)] was hydrolysed with no unusual difficulty under the same conditions.

25. THE DETERMINATION OF RESIDUES OF *O*-2,4-DICHLOROPHENYL *O,O*-DIETHYL PHOSPHOROTHIOATE ("V-C 13 NEMACIDE") BY CHOLINESTERASE INHIBITION.

George R. Boyd; *Research Department, Virginia-Carolina Chemical Corporation.*

The electrometric method of Giang and Hall for the determination of organic phosphates by cholinesterase inhibition has been adapted for use with *O*-2,4-dichlorophenyl *O,O*-diethyl phosphorothioate, the active ingredient of "V-C 13 NEMACIDE." This compound is itself only a weak inhibitor of cholinesterase. However, oxidation with nitric acid increases its activity by a factor of 1000 so that micro amounts can be determined by antiesterase activity. V-C 13 has greater stability and lower water solubility than Parathion or Systox and certain modifications of previously reported procedures are required in its determination. Other changes have also been made in the interest of increased operating efficiency.

These modifications were discussed and a detailed procedure for the analysis of vegetable products was given. Results were presented for the application of this procedure to the following analyses: solutions of pure V-C 13; extracts of vegetables grown in untreated soils; recovery of known amounts of V-C 13 added to vegetable extracts; and residues of V-C 13 found in vegetables grown in treated soils.

26. CHEMICAL LIBRARY RESOURCES IN VIRGINIA.

M. Hathaway Pollard; *Research Department, Virginia-Carolina Chemical Corporation.*

There are in Virginia over 100 libraries that collect chemical literature and cooperate in making it available to those who seek chemical information. Included are both public and "special" libraries such as school, government, and industrial. The services of these libraries are more numerous and varied than most of us realize. The special library, whose primary purpose is to provide specialized information and services to the personnel of its own organization, also provides information and literature to other librarians and, where practical, to the public. The public library not only makes its collection available to the public, but, where practical, offers specialized services such as photocopying and

assistance in literature searching. By consulting one of these libraries the chemist can open up a vast network of information sources locally, nationally and even internationally. The value of library research to the chemist can be measured in saving of time and dollars for himself and for his organization.

27. NUCLEAR REACTORS FOR RESEARCH.

W. E. Chamberlain; *AMF Atomics, Incorporated.*

Business Meeting

The Chemistry Section business meeting was held at 12:00 Friday, May 10, in the John Smith Room of Hotel Chamberlin. The practice of holding two concurrent sessions on Friday and none on Saturday was discussed. It was decided that the section officers would determine if this practice should be continued.

The report of the nominating committee was presented and the following officers elected by unanimous vote of the members present.

Chairman, J. C. Holmes; *Secretary*, F. A. Vingello; *Section Editor*, Mearl A. Kise.

MINUTES OF THE SECTION OF EDUCATION (6)

W. Donald Clague, *Chairman*

Evan G. Pattishall, Jr., *Secretary*

James B. Patton, Jr., *Section Editor*

FRIDAY, MAY 10, 1957 – 9:00 A.M. – PARLOR A

HOTEL CHAMBERLIN

1. THE QUALITY OF WRITTEN EXPRESSION OF VIRGINIA'S HIGH SCHOOL SENIORS.

Alfred L. Wingo; *Virginia State Department of Education.*

The over-all purpose of the study was to analyze the quality of written expression of Virginia's High School Seniors for the School Session, 1953-1954. The analysis that was made served the following detailed purposes:

1. To determine the value of the Total Score on the American Council on Education Psychological Examination, the L-Score on the same test, and the English Score on the Essential High School Contest Battery as predictors of the ability to write.
2. To compare the quality of written expression of pupils enrolled in college-bound programs of instruction with that of pupils enrolled in the general curriculum or non-college-bound programs.
3. To compare the quality of written expression of girls with that of boys.
4. To compare the seniors in the classifications of schools used in the study with respect to the quality of written expression.
5. To compare boys and girls with respect to both linguistic aptitude and achievement in English.

A large majority of the Seniors were requested to write an essay of 250 to 400 words on the topic: *What High School Graduation Means To Me.* With the advice and help of Dr. Richard A. Meade, Professor of Education, University of Virginia, a committee composed of three per-

sons was selected to judge the essays. Through the use of a controlled and stratified random sampling technique 366 papers were drawn from 14,911 for appraisal by the judging committee. The validity of the sample was established by comparing standardized test scores available for all seniors in the State with similar scores for the pupils included in the sample. The comparisons and statistical analyses used were developed in terms of the purposes stated in the preceding section. For the purpose of stating conclusions the Judging Committee classified the papers into five groups according to previously determined criteria for judging effectiveness.

Some conclusions:

1. The Judging Committee's "Conclusions" and assigned scores indicate a wide range in the quality of written expression for the sample as a whole. It appears that the top half of the group wrote very fine papers, but the quality of written expression trails off rapidly in the lower half, particularly below the 20th percentile.

2. As predictors of the ability to write, the three test scores used (Total A.C.E., L-Scores of the A.C.E., and English scores of the E.H.S.C.B.) differed slightly in value. The English scores were slightly better predictors than the total A.C.E. scores, and the total A.C.E. scores were somewhat superior to the L-Scores. With few exceptions the English scores predicted the quality of written expression within one quartile deviation; for example, a pupil in the top quartile for one measure would not be lower than the next to the top quartile in the other.

3. The essay scores of pupils, in the sample, enrolled in the college-bound programs of instruction are quite superior to those of pupils enrolled in the general curriculum.

4. The scores indicating quality of written expression for the girls in the sample are definitely superior to those for the boys; and to the extent that the L-Scores indicate linguistic ability, it appears that the girls achieve their potential in written expression to a higher degree than the boys.

5. From the City Whites, Twelve-Grade Systems down to the County Negroes, Eleven-Grade Systems there is a wide range in the quality of written expression. The test scores follow a similar pattern.

6. The essay scores of pupils, in the sample, enrolled in twelve-grade systems exceed by very substantial margins those of pupils in eleven-grade systems.

7. Although there are no substantial sex differences in the L-Scores, the girls made better English scores than the boys. It appears that the

girls in the sample have a greater flair for the mechanics of written expression as well as for the art.

2. CHANGES IN ATTITUDES RESULTING FROM TRAINING IN EDUCATIONAL PSYCHOLOGY.

Charles Martindale and George Kent; *Bridgewater College.*

The purpose of this experiment was to determine the effects of a course in Educational Psychology on attitudes toward teaching and teaching practices.

The Purdue Teachers Examination "How I Teach" was administered over a two year period at the beginning and again at the end of an 18-week semester to students registered in courses in Educational Psychology at Bridgewater College.

Significant improvement from pre to post test was found (.001). Checking further to determine if this improvement could be attributed to the course in Educational Psychology, the data were grouped for those students with previous education courses versus those with none; those students with previous psychology courses versus those with none; those students currently taking education courses versus those who were not; and those students currently taking other psychology courses versus those who were not. While significant differences between groups on pre tests and on post tests were observed, only in one case were the relative improvements between the groups significant. Those students currently taking other courses in psychology were higher on the initial test, but not significantly different on the final test; in this case the relative improvement was significant at .01 level of confidence. A final test of those students not taking other psychology courses revealed significant improvement at the .001 level of confidence.

It was concluded that previous courses in psychology and education, and current courses in education do not account for the improvement on superior on the first test. It was suggested that perhaps those factors which lead to the improvement on the attitude test were present in other psychology courses, consequently these students did not show a great increase during the course in educational psychology. It was concluded that there was a real improvement in the scores on the attitude test, and that this improvement could be attributed to the course in educational psychology.

3. SOME EFFECTS OF COLLEGE MENTAL HYGIENE COURSES IN PERSONAL DEVELOPMENT.

Donald W. Border and George W. Kent; *Bridgewater College.*

The purpose of this experiment was to examine the effects of a

the attitude test. Students currently taking psychology courses were college mental hygiene course on personal adjustment as measured by standardized personality tests.

Thirty-three members of a class in the Psychology of Adjustment at Bridgewater College served as an experimental group, and 33 members of a General Psychology class served as a control group. Three personality tests were administered to both groups at the beginning and again at the end of an 18-week semester. Significant improvement was observed in both experimental and control groups. However, only on three subtests did the experimental and control groups differ significantly. It is concluded that changes observed in personal development during the course of a semester's work in mental hygiene do not necessarily reflect the effects of this course alone. Rather it may be due to the effect of the college situation in general. A number of significant changes is greatly reduced when the comparison is made with other students not registered in mental hygiene. It was also observed that the experimental and control groups differed markedly in their use of the "undecided" category on the Johnson Temperament Analysis.

4. A STUDY OF PROBLEM SOLVING UNDER THREE EXPERIMENTAL CONDITIONS.

Frank W. Banghart; *University of Virginia.*

The purpose of this experiment was to investigate the role of specified interference on problem solving efficiency.

Eighty-one subjects were used. The subjects were all drawn from the same rural elementary school. An equal number was drawn from each of the fourth, fifth, and seventh grades. The subjects were divided into three levels of mental ability, upper third, middle third, and lower third. The subjects were divided into three experimental groups; one third worked non-cooperatively, one third cooperatively, and one third individually. The apparatus consisted of a panel equipped with ten colored lights mounted in a circle with a ten-inch diameter. The subject's task was to predict which light would come on next.

The results showed that the non-cooperative group did best, the individuals next best, and the cooperative group poorest. These differences were significant at the .01 level of confidence. The differences were, also, consistent at each grade level and at each level of mental ability.

5. MEASURING BEHAVIOR TRAITS IN ELEMENTARY SCIENCE.

Jack Boger; *Richmond Public Schools.*

One important aspect of the total evaluation program in elementary

science is concerned with behavior traits related to science-mindedness. Important traits include:

1. Curiosity
2. Creative imagination
3. Persistence
4. Manual dexterity
5. Planning ability
6. Ability to spot a problem or detect inconsistencies

One promising lead to evaluation which takes into consideration the behavior traits exhibited by pupils under controlled conditions is the situation type test. The situation type test subjects an individual or small group to a stimulus situation which is concrete and uniform enough for comparisons. The situation can be sufficiently structured or controlled to give pupils ample opportunity to engage in those types of behavior which the test maker proposes to measure.

Recording instruments such as a checklist or reading scales can be developed to study the situation imposed by the test. The situational test is difficult to design and administer, and it is subject to observer error in scoring, but it offers more promise than other available techniques for the assessment of typical behavior traits.

A pilot group of sixty grade children has been taking tests of the sort described above every few weeks during this school term. The results of this pilot study suggest that this is a fruitful area for action research in elementary school science.

SYMPOSIUM

Needed Research on the Gifted Child

Leon Reid, *University of Virginia;* Kuhn Barnett, *State Department of Education;* Virgil Ward, *University of Virginia;* William F. Koontz, *Norfolk County Public Schools;* Evan G. Pattishall, Jr., *University of Virginia, Moderator.*

BUSINESS MEETING

The report of the nominating committee was presented and the following new officers were elected: *Chairman,* Evan G. Pattishall, Jr.; *Secretary,* Charles J. Turner.

MINUTES OF THE SECTION OF ENGINEERING (7)

D. M. CRIM, *Chairman*

O. L. UPDIKE, *Secretary*

R. M. HUBBARD, *Section Editor* (1958)

FRIDAY, MAY 10, 1957 – 9:00 A.M. – PARLOR B

1. AN INVESTIGATION OF SOME ASPECTS OF TRANSONIC WIND TUNNEL DESIGN.

Arthur C. Bruce; *Virginia Polytechnic Institute.*

An experimental investigation was conducted to compare various methods of obtaining transonic Mach numbers slightly above one in a two dimensional slotted wall nozzle. Three distinct methods were applied to a nozzle with essentially parallel walls in order to alleviate choking near the nozzle exit. These methods consisted of modifying area ratios by means of bumps installed upstream of the test section, varying the pressure ratios along the test section by forced expansion of the flow through wall slots, and creation of a *vena contracta* upstream of the test section by installation of fences in the convergent portion of the nozzle.

Comparisons are presented on the basis of Mach number distributions along the working section, resulting ranges of available Mach number, and attenuation of wave reflection from the tunnel walls.

2. DETERMINATION OF THE AERODYNAMIC CHARACTERISTICS OF BODIES OF REVOLUTION IN AN AXIALLY SYMMETRIC PERFECT FLUID FLOW BY THE METHOD OF VORTEX RING DISTRIBUTION.

Charles R. Wilson and James B. Eades, Jr.; *Virginia Polytechnic Institute.*

This paper presents a method of predicting the incompressible pressure distribution for a body of revolution in a perfect fluid flow at zero angle of attack.

The present method uses the mechanism of vortex rings, in place of the usual source-sink method, which alleviates the difficulty

of the singularities on the axis encountered in the more classical source-sink analysis.

The investigation was initiated when it was found that the classical approach, when applied to a cone-cylinder body of revolution, did not give acceptable agreement with experiment. A comparison of this analysis will be made with experiment and with results obtained from the classical analysis.

3. SOME CONSIDERATIONS OF THE TRANSONIC AREA RULE.

Edgar B. Pritchard and Arthur C. Bruce; *Virginia Polytechnic Institute.*

The transonic area rule is applied to a cone cylinder and to several modifications of this basic body configuration. Experimental results are obtained in the transonic range of Mach numbers.

The first modification of the basic cone cylinder configuration was the addition of an unswept triangular wing to the body. A body of revolution having the same distribution of cross-sectional area as the wing body combination was tested as the second modification.

Drag coefficients were obtained in the transonic range of Mach numbers for each of the three configurations tested and variations with Mach numbers were presented.

A visual comparison of waves present on the three bodies is presented as obtained from Schlieren photographs and the present experimental results are compared qualitatively with Whitcomb's results for bodies of revolution with cylindrical after bodies.

4. FLOW IN THE FORWARD STAGNATION REGION OF BLUNT BODIES.....

Robert W. Truitt; *Virginia Polytechnic Institute.*

The purpose of this paper is to present methods of calculation which yield important information on the symmetric inviscid flow in the forward stagnation point region of blunt bodies for incompressible and hypersonic flow. Round and perfectly flat-nosed bodies are treated.

An analysis is made to show the conditions necessary to give exactly the modified Newtonian-type flow in the forward stagnation region of cylindrical, hemispherical and flat-nosed bodies at supersonic speeds.

The present theoretical results are compared with those of Li and Geiger and with available experimental data.

5. AERODYNAMIC HEATING ON BODIES OF REVOLUTION INCLUDING SLIP FLOW.

Adolf K. Anderson, Jr. and Robert W. Truitt; *Virginia Polytechnic Institute.*

A method for the determination of transient skin temperatures on bodies of revolution in turbulent and laminar-slip flow is presented. The method is applied to a typical missile trajectory by using the Runge-Kutta method of numerical integration. The stagnation point on the body is investigated to find the maximum skin temperature to which the body is subjected during this typical high-speed trajectory. A comparison is made between the skin temperatures at the stagnation point and at a location on the body which experiences turbulent heat transfer characteristics. It is found that the skin temperatures attained at the stagnation point of the body exceed the allowable limit.

6. STRUCTURAL PROBLEMS DUE TO AERODYNAMIC HEATING OF SUPERSONIC AIRFLAMES.

William Zuk; *University of Virginia.*

With the advent of aircraft velocities in excess of Mach 1, the structural designers of airframes are now faced with three new and important sources of difficulties over and above all the old ones of computing the stresses in a complex indeterminate structure as an airplane due to dead loads, aerodynamic forces, impact, and fatigue.

These three added problems are due to aerodynamic heat generated in supersonic flight causing creep, temperature softening, and thermal stresses in the materials and structural components. These factors are all inter-related in the complex structural frame; some merely causing additional deflections and increased stresses, but others causing more catastrophic effects as complete collapse due to reduced rigidity and buckling instability.

These effects will be explained in concept and practical importance in an airframe.

Several methods of analysis will also be discussed to evaluate these effects quantitatively, many of these methods being original with the author.

7. PROCESS DESIGN FOR THE PRODUCTION OF MALEIC ACID HYDRAZIDE FOR WEED CONTROL.

E. C. Moncrief, W. H. Sawyer and Frank C. Vilbrandt; *Virginia Polytechnic Institute.*

The effects of excess maleic anhydride, hydrazine hydrate to solvent ratio, time, concentration, specific solvents, agitation were studied. A reaction time of 12 minutes was employed with the ratio of solvent to

reactants held constant at 75 weight percent. Solvents employed were ethanol, methanol, isopropyl alcohol, glacial acetic acid, hydrochloric acid, benzene and water. Drying rates were also studied. Yields up to 70% immediate precipitation to 88% upon evaporation and crystallization were obtained.

Then field application of 0.10 to 0.22 weight percent hydrazide solutions in water were made in "wild" varieties of briers, Bermuda grass, Johnson grass, milkweed, red pine, ragweed, and honey locust in the Blacksburg area from May to August 1956. Field tests on the "wild" plots indicated 40 to 80% control on all plots and vegetation studied with the exception of milkweed and honey locust.

A total capital of $1,150,000 was determined to be necessary to produce annually 242 tons of 95.5% pure maleic acid hydrazide. A selling price of $3.00 per pound, or $0.50 per gallon of spray liquid, would yield 13.7% return as new earning plus working capital.

8. PLANNING PROBLEMS IN THE WASHINGTON METROPOLITAN AREA OF VIRGINIA.

Cadet John E. Woodward, Jr.; *Virginia Military Institute.*

The Washington metropolitan area in Virginia is undergoing tremendous growth. Comprehensive, coordinated planning by all the communities involved is necessary for the solution of the problems resulting from this rapid expansion. The purpose of this paper is to review generally the problems facing planners in the area.

9. A MOLECULAR LENS.

Paul R. Little, Robert L. Ramey, and Orville R. Harris; *University of Virginia.*

A force can be exerted on certain molecules possessing electric dipole moments when placed in non-uniform electrostatic fields. By shaping these non-uniform electrostatic fields, molecular beams can be formed. Various electric-field configurations have been extensively examined. From evaluating the different types of electrodes, a new focuser has evolved.

This new focuser is a series of stacked discs insulated from one another. There is an axial hole down the stacked discs through which the molecular beam is directed. By alternating the voltage on each disc, positive and negative, a space varying field can be shaped. This field will form a beam of molecules according to the initial velocity, change in dipole moment, and energy state in the molecule.

One application of such a lens is to focus a beam of ammonia mole-

cules for use in a molecular beam amplifier (MASER), resulting in improved separation, transparency, and beam composition.

10. AN INVESTIGATION OF THE MODIFIED NEWTONIAN-TYPE FLOW OVER A FLAT PLATE.

F. Wendell Johnson and Robert W. Truitt; *Virginia Polytechnic Institute.*

This paper presents a method of obtaining an analytical description of the modified Newtonian flow over a normal flat plate at hypersonic speeds. In particular the method of conformal mapping is used to find the flow over a flat plate from the known solution of the flow over a cylinder due to motion of a concentric cylindrical shell. The solution thus obtained is used to find the local Mach number distribution over the flat plate in the hypersonic speed range.

11. DETERMINATION OF PRESSURE DRAG ON BODIES OF REVOLUTION IN TRANSIENT FLIGHT.

Samuel J. Harris and Robert W. Truitt; *Virginia Polytechnic Institute.*

Theoretical investigation of the pressure drag on bodies of revolution for a typical high-speed, high altitude trajectory. A 10° semi-angle cone is analyzed over a trajectory covering Mach numbers from 2.14 to 10.39, and altitudes from 17,000 to 110,000 ft., by integrating the conical-shock solutions for the pressure distribution. An analysis is made on an ogival body with a fineness ratio of 3 at Mach numbers from 1.5 to 9, and altitudes from 4,000 to 190,000 ft., by integrating pressure distributions obtained by conical shock-expansion methods.

12. AN INVESTIGATION OF MODIFIED NEWTONIAN HYPERSONIC THEORY IN THE STAGNATION REGION OF CYLINDRICAL AND HEMISPHERICAL BODIES.

Jerry C. South, Jr. and Robert W. Truitt; *Virginia Polytechnic Institute.*

This paper presents a method of determining the flow characteristics in the stagnation point region of cylindrical and hemispherical bodies at hypersonic speeds. A detailed description of the embedded subsonic flow field is given. The region for local Mach number is 0.3 or less is calculated and the results are discussed.

13. EXPERIMENTAL COMPRESSIBLE PRESSURE DISTRIBUTIONS AND VELOCITY GRADIENT ON A 180° WEDGE.

Paul Taynton and Arthur C. Bruce; *Virginia Polytechnic Institute.*

A necessary step in the determination of skin temperature on a body in flight is the evaluation of stagnation of velocity gradients on the body surface. To this end, an experimental investigation was carried out utilizing a 180 degree, two dimensional wedge. Tests were conducted to cover the compressible flow range of Mach numbers from approximately zero to one.

From experimental results compressible pressure distributions are determined and comparison is made with existing compressible and incompressible theory. The experimental stagnation velocity gradients are also compared with theoretical predictions and consequent effects upon skin temperature are indicated.

MINUTES OF THE SECTION OF GEOLOGY (8)

TROY J. LASWELL, *Chairman*

RICHARD V. DIETRICH, *Vice-Chairman*

ROBERT S. YOUNG, *Secretary*

WALLACE D. LOWRY, *Section Editor* (1958)

FRIDAY, MAY 10, 1957 – 9:00 A.M. – PARLOR C

1. MAGNETIC INTENSITIES OF ROCKS NEAR LYNCHBURG.

H. R. Hopkins; *University of Virginia.*

During a vertical magnetic intensity survey carried on by the Virginia Division of Mineral Resources in the Lynchburg hematite and magnetite District the following relative magnetic intensities were found: Candler formation readings ranged from +400 to −300 gammas, (the adjusted average was −82 gammas); Archer Creek marble ranged from +400 to −400 gammas, (the adjusted average was −16 gammas); Archer Creek graphite schist ranged from +600 to −180 gammas, (the adjusted average was 83 gammas); the Mount Athos schist ranged from +500 to −600 with an adjusted average of 0 gammas; the magnetite-bearing Mount Athos quartzite had an average reading of +480 gammas, and the greenstone had an average reading of +2,500 gammas. No extensive magnetic anomalies were found which would indicate large iron ore deposits in the area.

A mapped extensive negative anomaly in the vicinity of Riverville is thought to be the result of polarization. A positive anomaly lies west of Stapleton, Amherst County. This anomaly is believed to be caused by the low southeast dip of the greenstone.

The magnetic intensities on the western edge of the metasediments next to the greenstone are unusually high and decrease in value away from the greenstone. They may indicate a series of low-angle thrust faults similar to the Bent Creek fault which dips 5-15° to the southeast.

2. STUDY OF HEAVY MINERALS OF SANDS OF TRIBUTARIES TO SOUTH RIVER, ROCKBRIDGE COUNTY, VIRGINIA.

James H. Davis, Jr. Randall Creel, Jr., and Robert Lurate;

Washington and Lee University.

Seventeen samples of sand were taken from the tributaries to South River, Rockbridge County, Virginia. This stream flows southward along the west foot of the Blue Ridge escarpment.

Minerals identified by standard petrographic methods were black opaques, zircon, tourmaline, hypersthene, epidote, staurolite, and garnet. These were found in sands of tributaries draining the Paleozoic sedimentary formations to the west as well as the Precambrian crystalline rocks to the east. No definite differentiation could be made. It is unlikely that significant quantities of hypersthene, epidote, staurolite, and garnet would be derived from Paleozoic sedimentary formations. Possibly they were derived from Blue Ridge and Piedmont sediment which had been transported by westwardly flowing streams and deposited on the Valley Floor peneplain before the development of the present valley of South River.

3. DESIDERATA FOR THE REPRESENTATIVE SAMPLE.

A. C. Lilly, Jr.; *Virginia Polytechnic Institute.*

Representative sampling has long been a problem in geology. A mathematical analysis of the problem suggests two "rules of thumb" regarding sampling: (1) the larger the volume of sample taken the greater the probability that the sample will be representative, and (2) the representative volume varies logarithmically with the degree of sorting; therefore more sample should be taken (on a logarithmic basis) in poorly sorted sediments than in well-sorted sediments.

Because in every sediment there are theoretically an infinite number of sizes, the geologist cannot hope to obtain a truly representative sample. He must sample size ranges and hope that his sampling gives the same results that a representative sample would give. Recognition of these limitations, themselves, is perhaps the most important aspect of sampling.

Perhaps the critical educated eye is, after all, the best control of procuring a representative sample — this, despite the fact that our literature is overloaded in favor of the peculiar.

4. STRUCTURAL POLYTYPISM AND THE SPIRAL GROWTH OF CRYSTALS.

Richard S. Mitchell; *University of Virginia.*

Certain substances crystallize in several modifications which differ basically only by the manner in which identical unit layers of structure are stacked upon each other. The cell dimensions of these different modifications usually vary only in the direction perpendicular to the stacked layers, and this variable dimension is a multiple of the thickness of the

unit layer. Structural polytypism has been observed in wurtzite graphite, mica, clay, cadmium iodide, silicon carbide and long chain organic compounds. Over thirty polytypes of silicon carbide, the classical example, have been discovered. These range from four layers to more than a thousand layers per unit of structure.

The numerous explanations of the phenomenon of polytypism, which have been concerned with impurities, temperature, rate of crystallization, influence of neighboring crystals, etc., have become quite inadequate with the discovery of the many layered types. A more satisfactory postulation is that polytypism might be brought about by the spiral growth of crystals as a consequence of screw dislocations. Polytypic structures would result if the exposed steps, produced by such dislocations, were of various heights and contained at least one departure from the ideal structure of the crystal. Recent investigations by the writer have shown that nearly all the known polytypes of cadmium iodide and silicon carbide can be derived by such a mechanism.

5. WEATHERED STREAM GRAVELS AT THE CREST OF THE BLUE RIDGE.

Richard V. Dietrich; *Virginia Polytechnic Institute.*

A significant deposit of alluvial cobbles and boulders occurs at the crest of the Blue Ridge near the eastern boundary of Floyd County, five miles S.37°E. of the Roanoke-Montgomery-Floyd counties' common point. The deposit occurs within the New River Basin a few feet from the present Atlantic-Gulf Divide which, in this area, essentially coincides with both the crest and the top of the Blue Ridge Escarpment.

The roundstones range up to 5 x 6 x 8 inches, are irregular to ellipsoidal, are subrounded to well rounded, and consist almost wholly of "bull" quartz and quartzite. That most of the roundstones have undergone chemical weathering since being deposited is manifest by development of friability, secondary porosity, and formation of one-to-three millimeter (s) thick iron-stained outer zones.

The presence of the deposit, along with underfit streams and other features, in this area indicates that large streams once existed here. If the drainage was to the west, and all evidence suggests this, the New River Basin must have once been much larger and have included a sizeable area east of the present Blue Ridge Escarpment.

6. VERMICULITE IN THE VIRGINIA PIEDMONT.

Edwin O. Gooch; *Virginia Division of Mineral Resources.*

Vermiculite is the name given a group of hydrated silicate minerals, with a mica-like cleavage, that have the peculiar quality of expanding when heated. Although vermiculite is a distinct mineral species, some of

the materials classified as vermiculite are mixed-layer mica-vermiculite structures. X-ray determinations are necessary to distinguish vermiculite from the mixed-layer mica-vermiculites.

Because of their ability to expand when heated, the uses of vermiculite and the related mica-vermiculites have developed rather rapidly in recent years. Today there is a growing demand for vermiculite products, especially in the building industry.

Vermiculite and the related mica-vermiculite mixtures probably are found as constituents of many of the basic rock formations in the Piedmont province in Virginia. However, recent studies show that there are concentrations of these minerals in at least six areas in the Piedmont. These areas are found in Louisa County, Buckingham County, Bedford-Franklin counties, Pittsylvania-Franklin counties, Henry County, and Charlotte-Halifax counties.

7. ZIRCON IN A BENTONITE BED IN MARTINSBURG SHALE AT FISHERS HILL, VIRGINIA.[1]

Dorothy Carroll; *U. S. Geological Survey.*

A number of bentonite beds, originally volcanic ash, in the Martinsburg shale at Fishers Hill, Shenandoah County, Virginia, have been described by Roy A. Bailey and Robert S. Young. The heavy residue from the lowest of these beds, approximately 1 foot above the base of the Martinsburg, consists almost entirely of euhedral, unabraded grains of zircon averaging 95 microns in length and 35 microns in breadth. The zircon varies from colorless to very pale yellow and crystallographically is all of one type with well-developed prism and pyramid faces. A zircon concentrate was prepared by Howard W. Jaffe and the age determined by the total lead-alpha activity ratios (Larsen method) to be 340 + 35 million years. Although age determinations from single samples are of little value, it is significant that the age found is within the range obtained for igneous rocks of Ordovician age using the same method, and also that given in Holmes' time scale. Heavy residues of samples of Martinsburg shale from other localities contain a number of different types of detrital zircon including purple grains which are generally considered to be of Precambrian age.

8. HEAVY MINERAL STUDIES OF SEDIMENTS FROM LITTLE RIVER, FLOYD COUNTY, VIRGINIA.

Carl Mangold, Jr., Lee Marshall, W. K. Young; *Washington and Lee University.*

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[1] Publication authorized by the Director, U. S. Geological Survey.

Fourteen samples of sediment were collected from the Little River, Floyd and Montgomery counties, Virginia. The samples represent the entire length from its origin to its confluence with New River.

Slides made of the heavy minerals showed that amphiboles and pyroxenes, muscovite, opaques, and zircon were by far the most abundant minerals with rutile, sillimanite, tourmaline, staurolite, and garnet present only in rare quantities. No definite correlations could be made between the samples and specific or individual formations of the Little River's drainage basin.

9. LARGE CALCITE CRYSTALS FROM STAUNTON, VIRGINIA.

William F. Giannini; *University of Virginia.*

Unusually large and well developed calcite crystals occur in the Beekmantown limestone of the Belmont Trap Rock Company quarry within the city limits of Staunton, Virginia. The quarry, owned and operated by Mr. C. W. Lawrence and sons, is approximately 300 feet long, 100 feet wide, and 150 feet deep. The calcite crystals are best exposed on the wall at the southeast end of the quarry and they occur in fractures and vugs. Perhaps the fractures were developed during folding, whereas the vugs probably resulted from subsequent enlargement of these fractures by solution.

The size of the largest crystal found was 6 inches parallel to the *a* crystallographic axis and 3½ inches parallel to the *c* crystallographic axis. The common basic forms observed on the crystals are rhombohedrons, scalenohedrons, and prisms. The negative, modified rhombohedron (0112) was present on all crystals observed. Iron oxide is closely associated with the crystals. In some crystals the oxide imparts a uniform pale yellow coloration whereas in others it produces a definite zoning of various shades of yellow and brown. In addition to this many crystals have an external coating of iron oxide. Many specimens contain phantoms which are coated either with iron oxide or small pyrite crystals.

10. NON-TECTONIC FOLDS IN THE ATHENS FORMATION NEAR HARRISONBURG, VIRGINIA.

W. D. Lowry; *Virginia Polytechnic Institute.*

Folds of non-tectonic origin occur in the black, very fine grained Athens limestone in the Jamison Black Marble Company quarry about one mile north of Harrisonburg, Virginia. Most of the individual folds are less than several feet across. They comprise an unsystematic group of tight disharmonic folds which show marked thickening in their axial portions. The folding is believed to be the result of flowage while the beds were still incoherent. The beds comprise a zone several feet thick and

overlie a group of rather steeply foreset beds. The foreset bedding and the flowage exhibited by these Athens limestones indicate instability of the sea floor at the time of deposition. Such instability may be related to the structural setting of these beds. They lie on the west flank of the Harrisonburg anticline which is known to have begun to form in Middle Ordovician time.

11. CHERT IN THE MURAT-COLLIERSTOWN AREA, ROCKBRIDGE COUNTY, VIRGINIA.

Raymond S. Edmundson; *University of Virginia.*

Chert in the Beekmantown dolomite at a locality along Buffalo Creek about one mile northwest of Murat and four miles southwest of Lexington shows the following form types: (1) lattice (intersecting fracture fillings), (2) nodular; (3) mottled, and (4) bedded. The general structure in this area is a broad anticline plunging southwestward. The upper part of the Beekmantown is repeated across the axis of the fold.

Masses of chert were x-rayed and gave definite lines for crystalline silica, although they appear isotropic and frequently minutely speckled under crossed nicols. A few of these isotropic occurrences grade into marginal zones of microcrystalline quartz in which individual grains are easily recognizable under low magnification. Another type of silica is chalcedony which appears as microfibrous quartz and occurs in sheaves with banding perpendicular to the length of the fibers.

All the categories of chert, except for small cavity fillings and secondary veinlets which cut across both chert and host rock, show evidence of replacement. Criteria include irregular contacts between chert and dolomite and the occurrence of considerable dolomite in chert both as dusty inclusions and euhedral grains.

12. SPHERULITIC PHOSPHATE CONCRETIONS FROM BIG HORN BASIN, WYOMING.

Richard S. Mitchell and W. Cullen Sherwood; *University of Virginia.*

The occurrence of light gray spherulitic phosphate concretions in the basal part of the Thermopolis formation (Upper Cretaceous) in the Big Horn Basin, Wyoming has been known for over fifty years. In 1935 McConnell published a thorough petrographic description of these concretions, which he determined were composed primarily of dahllite, the carbonate-hydroxyapatite. In this report he suggested the forms might represent replacement of some other material, but was unable to find relicts of a replaced material. Recently the writers have found evidence to show that these masses are actually pseudomorphs of dahllite after pyrite.

The concretions are spherical in shape, have a rough external surface, and average slightly more than one inch in diameter. Internally they exhibit radiating fibers of dahllite, and in places contain pyrite, which may show interstitial clay. Iron oxide is always at the center of the masses. The powder x-ray diffraction method permitted the definite identification of pyrite, dahllite, kaolinite, goethite and hematite.

Thin sections show that dahllite ranges in size from powdery masses to microscopic hexagonal prisms. The replacement of pyrite fibers by dahllite was observed in thin sections. Dahllite microlites are both parallel and transverse to the pyrite fiber directions. The presence of iron oxide rims around unreplaced pyrite islands suggests that oxidation was subsequent to the phosphatization.

A striking similarity was noted between the structure of these pseudomorphs and an unaltered pyrite concretion from a different locality which was sectioned for comparison.

13. ORIGIN OF ORDOVICIAN DOLOMITE-BEARING CARBONATE ROCKS IN VIRGINIA.

C. R. B. Hobbs, Jr.; *Virginia Polytechnic Institute.*

From a study of the dolomite-bearing carbonate rocks of Ordovician age in Virginia petrographic data which bears on the problem of dolomite genesis has been assembled. The results of this study show that because dolomite locally occurs with increasing abundance within oolites, pellet limestones, and finely granular limestones, the introduction of magnesium ions in the calcium carbonate sediments is believed to have taken place where there was low permeability, but high porosity. Further, the sea water within these sediments is believed to be static pore water or at best sluggishly circulating pore water. Diffusion of magnesium ions through the static pore water caused the transformation of calcium carbonate to calcium magnesium carbonate. The resulting formation within the parent calcium carbonate sediment zone is believed to have occurred near the sea water-sediment interface. Below this zone but still at a shallow depth dolomite may have developed along slump structures formed in the carbonate sediments. Diffusion of magnesium ions in static pore water permitted the formation of dolomite within slump faults and adjacent carbonate laminae. The environment of the carbonate sediments was one of shallow seas that covered flat extensive sea floors which were intermittently exposed to the atmosphere.

14. RELATIONSHIP OF IGNEOUS INTRUSION TO THE NORTH MOUNTAIN THRUST, NORTH RIVER GAP AREA, VIRGINIA.

Mark Fara; *Virginia Polytechnic Institute.*

Several igneous dikes, at least one of which appears to cut across the trace of the North Mountain fault, were mapped during the course of field work in the North River Gap area of Augusta County, Virginia. The crosscutting dike was not seen in direct contact with the rocks of the overthrust sheet. However, a questionable outcrop of igneous material is present on the upthrown block approximately 50 feet southeast of the fault trace. If this material is in place, and it is firmly believed to be so, the dike does cut across the trace of the fault.

Assuming that all of the dikes in the Shenandoah Valley are of the same age and that the dike does cut across the trace of the fault, the following conclusions can be made:

1. The igneous bodies of the Shenandoah Valley were not emplaced until after completion of folding and faulting associated with the so-called Appalachian orogeny.

2. The igneous intrusions have no preferred structural position.

3. Their locus of intrusion does not favor a particular lithology.

Although the dikes may occupy shear fractures, the igneous material is believed to have risen along tensional fractures extending into the basement. Apparently, the fractures were developed essentially perpendicular to the compressional forces as a result of unexplained mechanical conditions set up when the compressional forces were relaxed.

15. TWINNED CALCITE CRYSTALS FROM LONE JACK QUARRY, ROCKBRIDGE COUNTY, VIRGINIA.

Troy J. Laswell; *Washington and Lee University.*

Calcite twins of the contact variety are found in cavities in the Lower Cambrian Shady (Tomstown) dolomite in the Lone Jack Quarry near Glasgow, Virginia. The twins are scalenohedrons (hkīl), with the basal pinacoid ($\infty a : \infty a : \infty a : c$) (0001) serving as the twinning plane. The two parts of the twin, therefore, have the same vertical axis. This type of twinning is not uncommon in the mineral calcite. The specimens from this Rockbridge locality are of note because of the size (as much as six inches in length) and the degree of perfection of the specimens.

16. THE DIVISION OF MINERAL RESOURCES OF THE VIRGINIA DEPARTMENT OF CONSERVATION AND DEVELOPMENT.

Marcellus H. Stow; *Washington and Lee University.*

The former Virginia Geological Survey has been reorganized and is now officially the Virginia Division of Mineral Resources. Dr. James L. Calver is Commissioner of Mineral Resources and State Geologist. The

Division will function with two major objectives: (1). development of scientific and technical studies of the geology and mineral resources of Virginia, and (2) development of economic studies pertaining to the utilization of these resources.

Branches of the Division will include mineralogy and petrology, stratigraphy and structure, geophysics and geochemistry, economic geology (metallics, non-metallics, fuels), and mineral economics.

Technical and scientific objectives will include: (1) to determine the occurrence, extent, and quality of the State's mineral resources; (2) to map and describe the geological formations and features of the State by counties; (3) to map and describe the geological formations and features of the State by 15 minute quadrangles; (4) to prepare and keep up to date a key map showing status of geologic mapping of Virginia; (5) to complete and modernize the topographic mapping of Virginia; (6) to revise and publish the manuscripts now in the files of the Division; (7) to prepare and publish two volumes on the geology of Virginia: (a) a technical edition, (b) a popular edition; (8) to examine and identify specimens of rocks and minerals of the State as requested by residents or landowners; (9) to prepare and distribute sets of Virginia rocks and minerals, for nominal charge, to schools, clubs, other organizations and individuals; (10) to prepare and publish maps and popular reports on the geology of the State Parks.

Application of technical and scientific investigations to the economic development of Virginia's mineral resources will include: (1) interpretation of the technical and scientific studies through publications designed for public information and understanding; (2) determination of present and potential uses of the State's minerals, the present and potential market, and publication of this information; (3) encouragement of prospecting and exploration for economically valuable minerals and rocks; (4) promotion of best use and prevention of waste of mineral resources; (5) collection and publication of up-to-date statistics on the State's mineral production; (6) preparation and publication of reports on the minerals and rocks of economic importance; (7) advisory and technical assistance to individuals, local governments, business organizations and industries concerning the use of Virginia's minerals; (8) development of close cooperation with other divisions of the Department of Conservation and Development and other State and municipal agencies; (9) development of a close professional relationship with the schools of Virginia.

17. MINERAL RESOURCES ALONG THE NORFOLK AND WESTERN.

L. E. Ward, Jr.; *Norfolk and Western Railway, Roanoke, Virginia.*

The prosperity and wealth of an area can be measured rather accurately by the tonnage hauled by the railroads serving it; and conversely

the economic health of a railroad reflects the economic prosperity of the area it serves. Beginning in the early 1880's, the Norfolk and Western started mineral investigations within its territory. Mineral economics has been a concern of the railroad since the early 1900's. For example, in 1909 the railroad's industrial agent predicted the development of a large cement industry in the Roanoke area – a prediction that came into reality with the erection of Lone Star's large cement mill near Cloverdale nearly 40 years later.

Since 1948, the Norfolk and Western has supported a continuing program of geologic research designed to explore for and collect specific data on the mineral resources within its territory. Much of this work is done under the aegis of the Virginia Engineering Experiment Station at V.P.I. Thesis work of selected graduate students in geology is supported by the railroad. During the past decade more than 40 detailed reports on various resources have been prepared for use of the railroad's industrial and agricultural department.

BUSINESS MEETING

The sessions of the Geology Section were attended by about fifty geologists. Following the discussion of the last paper a brief business meeting was held. Upon the recommendation of the nominating committee the following officers were elected:

Chairman – R. V. Dietrich; *Vice-Chairman* – J. T. Hack; *Secretary* – R. S. Mitchell; *Section Editor* – W. D. Lowry. The meeting was adjourned at 4:45 P.M.

FIELD TRIP

The annual field trip, which took place Saturday, May 11, was to Jamestown Island. The leaders of the trip were Mr. John L. Cotter, Archeologist of the Park Service, and Dr. John T. Hack of the U. S. Geological Survey. The part of the program conducted by Mr. Cotter included an illustrated lecture on the archeological excavations on the Island, a tour of the museum, and a trip around the Island. Dr. Hack spoke on the geology of the Island and noted changes in the shoreline since the first settlement. Thirty people took part in the trip.

MINUTES OF THE SECTION OF MEDICAL SCIENCE (9)

L. E. EDWARDS, *Chairman*

G. M. DUNCAN, *Secretary*

W. P. ANSLOW, JR., *Section Editor*

FRIDAY, MAY, 10, 1957 – 9:00 A.M. – CHAMBERLIN CLUB ROOM

1. DIALYSIS AS AN ANALYTICAL TOOL.

Hans Hoch and Ray C. Williams; *Medical College of Virginia.*

The rate of transfer through a cellophane membrane was studied for benzoic acid, salicylic acid, phenylacetic acid (PA) and thyroxine (THY) in order to test the assumption that rate of transfer is proportional to the difference of the activities on both sides of the membrane. The four substances gave straight line plots of log concentration *vs* time, as was found previously for other substances by Canals (1955) and Craig (1957). A mixture of PA with 2.1% THY gave plots of log concentration *vs* time which were concave with respect to the coordinate axes. Both, more slowly and more rapidly dialyzing "impurities" will cause concave plots. It was possible to distinguish between the two by graphing ($\triangle$ log conc.)/($\triangle$ time) *vs* time.

Normal serum that had been brought to pH 6 with HCl to eliminate the bicarbonate buffer, was dialyzed against 1/8 volume of 0.11 N NaCl which was replaced 10 times at hourly intervals. For a single dialysis rate coefficient the ratio of the concentration in the dialysate at the end, to the concentration in the serum at the beginning should be the same for all hour periods. This was found for the absorbances at 280 $m\mu$. But at 250 $m\mu$ the absorbencies indicated a substance or substances of appreciably smaller dialysis rate.

2. EFFECTS OF ORAL HYPOGLYCEMIC COMPOUNDS ON THE METABOLISM OF ISOLATED INTACT FROG MUSCLE.

D. R. H. Gourley, *University of Virginia.*

When ingested orally, sulfonylurea compounds such as carbutamide and tolbutamide cause hypoglycemia in many species but the mechanism

by which this is achieved is as yet unknown. The hypoglycemic hormone, insulin, increases the oxidation of lactate and the influx of potassium ions in isolated frog muscle. However, neither carbutamide nor talbutamide exert these effects in frog muscle but each influences metabolism differently. Carbutamide, like sulfanilamide, inhibits the oxygen consumption of frog muscle *in vitro* and potassium leaks from the tissue. The same concentration of tolbutamide greatly increases the oxygen consumption without added substrate and slightly increases potassium influx into this tissue. Although no contractions were observed visually and the muscles retained their irritability throughout the experiments, tolbutamide caused a great decrease in muscle glycogen and an accumulation of lactate. The effect of tolbutamide on oxygen consumption was inhibited by sodium azide which suggests that the increased utilization of oxygen was to oxidize the accumulated lactate. The small effect on potassium influx is probably a secondary effect due to lactate oxidation. Thus a change in the sulfonylurea molecule from a $-NH_2$ group (carbutamide) to a $-CH_3$ group (tolbutamide) completely reverses the effects of the molecule on frog muscle metabolism.

3. MOTION PICTURES OF TISSUE CHANGES IN REGENERATING ZONES OF IRRADIATED TADPOLES.

Carl Caskey Speidel; *University of Virginia.*

These pictures portray various tissues in regenerating tail zones of irradiated tadpoles. They demonstrate the extent to which the progressive changes of regeneration may proceed even in animals that have already received a lethal dose of x-rays. Partial tail amputation is combined with whole-body x-ray irradiation. This results in a conflict between two opposing influences, namely, a strong localized regenerative urge leading to growth of a new tail tip, and a severe general injury from radiation leading to degenerative changes and death of the animal. The least regeneration and the greatest susceptibility to infection were noted in those tadpoles irradiated several days before the tail was sectioned. Scenes are presented showing the early progressive changes in tissues of regenerating zones of tadpoles destined to die from radiation injury already received. Other scenes are presented showing the late regressive changes that ultimately result from the radiation treatment. Invasion of the tissues of irradiated tadpoles by *Tetrahymena*, a protozoan facultative parasite, is also shown.

4. THE TRANSPORT OF DYE BY THE RENAL TUBULAR CELLS. (*Sound Movie*).

E. Lovell Becker and Dr. Sidney Solomon; *Medical College of Virginia.*

This film demonstrates certain basic phenomenon involved in the renal tubular transport of various dyes, using *in vitro* preparations of the goldfish kidney. Procedure is a modification of that developed by Forster as reported in Science in 1948. Particular phenomenon which will be demonstrated are; (1) the transfer of certain vital acidic dyes by the renal tubular cells, (2) the biological separation of a dye impurity from its parent compound, (3) competition for transport by two different dyes, (4) the influence of a carbonic anhydrase inhibitor on acid secretion by the tubule, (5) self blockade with high levels of dye in the medium, and (6) neutral red accumulation in the presence of high potassium, low calcium media.

5. REACTIONS OF ENZYMES TOXIC PHOSPHORUS COMPOUNDS.

L. A. Mounter and H. C. Alexander, III; *Medical College of Virginia* and *University of Virginia.*

Data will be presented for the pH dependence and dissociation constants (pK) of hog kidney dialkylfluorophosphatase and rabbit serum A-esterase, both of which hydrolyze diisopropylfluorophosphate (DFP). Similiar results will be presented for red cell cholinesterase, serum cholinesterase, chymotrypsin, trypsin, wheat germ lipase, thrombin and plasmin, all of which are inhibited by DFP. The results suggest that the imidazole group of histidine is present in the active centers of each of the enzymes studied. A number of different types of organophosphorus compounds was tested for their effects on these enzymes. Several new potent inhibitors for chymotrypsin, trypsin, plasmin and lipase will be described. In all cases the rate of reaction appears to be related to the steric structure of the organophosphorus compound.

6. IRREVERSIBLE SHOCK PRODUCED BY TEMPORARY CEREBRAL ISCHEMIA IN CATS.

Eugene D. Brand; *University of Virginia.*

Temporary bilateral occlusion of the common carotid and vertebral arteries, if prolonged for more than 3.5 hours, will result in the delayed onset of typical irreversible shock. During the period of occlusion and for about three hours thereafter the arterial pressure is high or normal.

Then a progressive fall in pressure sets in leading to death of the animal, in cardiorespiratory arrest. With artificial respiration supplied however, the blood pressure levels off again at about 30 mm Hg and this pressure is maintained for several hours. Eventually pressure again begins to fall terminating the death of the animal. This course can

be interpreted as being due to a delayed failure of the vasomotor mechanism in the central nervous system. The prolonged maintenance of very low pressure after the development of shock suggests that the peripheral cardiovascular system is not, as is often assumed, in a state of progressive decompensation. In a limited number of cats subjected to irreversible hemorrhagic shock the course was essentially the same. Thus it would appear plausible that the basic mechanism involved in the two conditions might be the same. Further studies designed to evaluate this hypothesis are planned.

7. HISTOCHEMICAL STUDIES ON TRYPAN BLUE AND RELATED DYES.

John W. Kelly; *Medical College of Virginia.*

An earlier study of anionic disazo dyes showed that Congo red, benzopurpurin and trypan blue display significant, perhaps useful, hue shifts with certain tissue components. Subsequent *in vitro* reactions of these dyes with appropriate substrates suggested but did not prove that the histological observation on trypan blue, a marked red staining by a blue dye, reflected selective staining by the components of an impure dye and not, as is true of Congo red, a spectral shift of a pure dye in a bound state. Statements on a red fraction in trypan blue (or Evans blue) were found in the literature and were usually related to renal studies. Few histological observations of the red component have been made and no special studies of the properties of this impurity were found.

A detailed study was therefore made on five samples of trypan blue, in particular, with additional investigation of seventeen samples of eight related dyes. Dyes were characterized and/or separated by paper and column chromatography, solvent partition, and dialysis, followed by spectral analysis of the fractions. Histological studies of whole dyes and fractions were based on human, dog, rabbit, rat and frog tissues. Additional histochemical tests and microspectrophotometric study were made on selected sections, in order to learn about the chemical basis for the highly selective reaction of the red dye in trypan blue. One factor is clearly the basic protein content of some tissue structures, illustrated by erythrocytes (globins), most nuclei (histones), and sperm nuclei (protamines). Other factors must be involved in the staining of blood serum and certain sites in the connective tissue ground substance; these are speculative at present and were discussed.

8. METABOLIC EFFECTS OF 3,3'5-TRIIODOTHYRONINE GIVEN ORALLY TO RATS.

C. L. Gemmill; *University of Virginia.*

Experiments reported in the Amer. J. Physiol. (187, 323, 1956) in

which high metabolic rates in rats were observed following the placing of 3,3',5-triiodo-l-thyronine in their drinking water have been continued and extended. When 26 micrograms per 100 ml. of drinking water were used, the metabolism rose to 50 Calories per sq. meter of body surface per hour while on 52.5 micrograms, the metabolism rose to 99 Calories. On the higher dosage levels, there was considerable mortality. The heart sizes of the rats on triiodothyronine were greater by weight than the heart sizes of the control groups. Similar changes in heart weight were observed in mice on triiodothyronine. Pulse rates obtained from electrocardiograms of the rats on triiodothyronine varied from 470 to 520, of normal rats from 336 to 380 and of hypothyroid rats from 190 to 230 beats per minute. These rates were obtained with the rats under sodium pentobarbital anesthesia.

9. SOME PROPERTIES OF THE FAT-FREE BODY OF THE GUINEA PIG.

Grover C. Pitts; *University of Virginia.*

The carcasses of 47 adult guinea pigs were studied by dissection, freeze-drying and fat-extraction. Conclusions were based upon calculations made on four other published studies as well as our own. A positive correlation between fatness and fat-free body weight (FFBW) was found. Per cent of water in the FFB was shown to be precisely regulated and independent of fatness or FFBW. Specific gravity of the FFB was independent of FFBW but equivocal results were obtained on its correlation with fatness.

10. EFFECTS OF PENTOBARBITAL ON THE UPTAKE OF P32 IN THE RAT.

P. Lingjaerde, O. J. Malm, R. A. Natvig and O. E. Skaug; *Medical College of Virginia.*

The effect of pentobarbital on the 2.5 hours uptake of P32 in the adult male rat has been investigated.

Series 1. Pentobarbital sodium in a dose of 3 mg/100 gm of body weight was given 10 minutes before the administration of P32. Thereafter 30 per cent of the initial dose was given every 45 minutes throughout the uptake period. A decreased uptake is found in thymus, pons, thalamus, cerebellum ($P<0.001$), medulla oblongata, blood (P 0.01), cortex cerebri, hypothalamus and liver (P 0.05), as compared with normal controls. The diaphragm uptake is increased (P 0.001). The uptake is normal in the pineal gland, anterior and posterior pituitary, adrenal cortex and medulla, thyroid and pancreas.

Series 2. Pentobarbital sodium in a single dose of 3 mg/100 gm of body weight was injected 2 hours before administration of P32, at which time the animals were fully awake. Increased uptake is found in the

diaphragm ($P<0.001$), cortex cerebri (P 0.01), hypothalamus, liver (P 0.02), cerebellum ($P<0.04$), and medulla oblongata (P 0.05), as compared with the normal controls. The uptake is normal in the pineal gland, anterior and posterior pituitary, adrenal cortex and medulla, thyroid, pancreas, thymus, blood, pons and thalamus.

11. HYPOGAMMAGLOBULINEMIA IN CHILDREN UNDER THE AGE OF 12 YEARS.

Cornelia Hoch-Ligeti and Joyce P. Hobbs; *University of Virginia.*

Serum protein patterns of children under the age of 12 years were studied by paper electrophoresis.

The statement of previous authors that infants, even during the period of physiologically low serum gamma globulin in the first 2 years of life, react to infection with an increase of gamma globulin could not be confirmed.

In a series of 150 children suffering from repeated infections, 80% of the children below the age of 2 years and 34% of those between the ages of 2 and 12 years did not react to repeated infections with an increase of serum gamma globulins. It is suggested that these children are in a state of decreased immunological reactivity. In 3 children with repeated infections the serum gamma globulin fraction was completely absent.

In a group of 50 children in comparable age groups which were well or had various clinical complaints but not repeated infections, increased gamma globulins were found in 44% of the cases.

During the first 2 years of life low gamma globulins were often associated with increased alpha2 globulins. Above this age low gamma and low alpha2 globulins were observed together.

In children with low gamma globulins the total serum proteins were slightly lowered.

The reaction between serum gamma globulin levels and the total and differential white count is under investigation. It seems that leukocytosis in response to infections is more prominent in children with normal gamma globulins.

A group of children, which did not show increased serum gamma globulins in response to repeated infections, showed marked clinical improvement on parenteral administration of gamma globulin.

12. INDIRECT HEMAGGLUTINATION STUDIES ON SALMONELLOSIS OF CHICKENS.

John McNeill Sieburth; *Virginia Agricultural Experiment Station.*

A comprehensive Salmonellosis control program for the poultry industry will only result when all or most of the 60 species (5 serogroups) that occur in poultry are tested for in breeding flocks before they are used as a source of hatching eggs. Single species agglutination tests are used at present. This study was undertaken to determine if the indirect hemagglutination system would be applicable as a polyvalent diagnostic test.

Chicken erythrocytes sensitized with the supernatant fluid of heated *Salmonella* cell suspensions were used for the indirect hemagglutination test which was compared with the agglutination test. White Leghorn chickens were orally infected with *Salmonella typhi-murium, S. montevideo, S. pullorum* and *S. anatum;* serum samples were obtained at certain intervals and all birds were cultured at the conclusion of the experiments. Serum samples were also obtained from chickens naturally infected with *S. typhi-murium* and *S. heidelberg.*

Indirect hemagglutinins appeared earlier, were consistently higher and persisted longer than agglutinins. The actual titre increase was also consistently higher for the indirect hemagglutination tests. Heterologous group specific and polyvalent indirect hemagglutinin titres were within one tube of the species-specific monovalent titres. In groups of chickens receiving an inoculum insufficient to infect all individuals, the serological and cultural results did not always correlate. The spread in polyvalent indirect hemagglutinin titres between uninfected chickens and those from a flock naturally infected with *S. typhi-murium* appeared adequate for diagnostic purposes.

13. *Escherichia coli* AS A PATHOGEN IN CHICKENS AND TURKEYS.

W. B. Gross; *Virginia Agricultural Experiment Station, Blacksburg.*

Chronic respiratory disease is a common respiratory infection of chickens and turkeys which is caused by a pleuropneumonia-like organism (PPLO). In its uncomplicated form it is characterized by a chronic lymphoid inflammation of the trachea, lungs and air sacs with low mortality and high morbidity. The disease may exist in a latent form or may result in a reduction in weight gain or in egg production. When complicated with *Escherichia coli* periods of high mortality with an acute course in individual birds are observed. The lesions are characterized by fibrinous pericarditis, perihepatitis, salpingitis and panophthalmitis. Microscopically the lesions consist of infiltrations by heterophiles and mononuclear phagocytes with a tendency to form giant cell barriers around necrotic areas.

Strains of *E. coli* could be isolated from the pericardial sacs in all field cases. These cultures could be classified into 6 serological types des-

ignated as a, b, c, d, e, and f by their "O" antigens. Only 3 of these types, b, c, and d, were found from more than two sources and type c was by far the most common.

When these strains were inoculated into the air sacs of chickens as few as 7 viable cells resulted in pericarditis in 1/15 birds. If PPLO were also present 9/15 birds developed pericarditis. About 500,000 viable organisms were necessary to produce pericarditis when they were inoculated intravenously. The presence of large numbers of pathogenic organisms in the intestinal tract did not result in pericarditis even in the presence of severe PPLO infection.

Pericarditis often followed the exposure of PPLO infected birds to aerosols of *E. coli* containing a total of as few as 600 organisms. Apparently individual birds are extremely susceptible to *E. coli* aerosols for only a short period in the course of the disease. At these times there is increased mitosis in the lymphoid cells and hyperplasia of the lining epithelium of the air sacs.

The production of salpingitis was correlated only with infection of the adjacent left greater abdominal air sac.

14. EXCHANGE ADSORPTION MECHANISM OF ACTIVE ION TRANSPORT.

E. G. Huf, N. Doss and J. Wills; *Medical College of Virginia.*

Active ion (NaCl) transport across isolated frog skin is discussed in relation to sodium and potassium composition and to O_2-consumption of skin. A distinction is made between processes in skin related to "*unidirectional active ion transport*" and processes related to *maintenance electrolyte equilibrium*," i.e., ionic composition of skin. Several metabolic inhibitors were found that could be used in separating maintenance electrolyte equilibrium from unidirectional active ion transport. Fluoroacetate (up to 1×10^{-2}M/1) did not affect maintenance electrolyte equilibrium, but severely diminished the rate of active ion transport. This could also be accomplished with azide and diethyl malonate when 1×10^{-3} molar concentrations were used. When applied in higher concentrations, these two inhibitors, and several others, diminished active ion transport, but this was associated with changes in maintenance electrolyte equilibrium (gain of Na+ by loss of K + from skin). Similar observations were made when skins were subjected to K+—deficient media. Mersalyl and theophylline, in low concentrations, stimulated active ion transport without leading to changes in maintenance electrolyte equilibrium. Inhibition of active ion transport was found accompanied by decrease, increase and unaltered overall O_2-consumption, depending on the kind of chemical agent used. A provisional scheme of the mechanism of unidirectional active ion transport is proposed. It is conceived as a process

of metabolically supported ion exchange absorption, involving a carrier, forming complexes with K+ and Na +, a trigger, K + ions and two spatially separated metabolic pathways.

15. AN EXPERIMENTAL ANALYSIS OF THE GENETOTROPHIC THEORY OF ALCOHOLISM.

Ebbe Curtis Hoff; *Medical College of Virginia.*

According to Williams' genetotrophic concept of alcoholism, uncontrolled craving for alcohol in alcoholics is ascribed, partly at least, to nutritional deficiencies arising from abnormally high needs for certain nutrients. Since Rogers has reported that glutamine administration to rats reduces voluntary alcohol consumption and in alcoholic patients appears to favor controlled alcohol intake, the present pilot study was conducted to evaluate oral use of glutamine in alcoholic patients attending an out-patient clinic. Of ten male volunteers, five were selected at random for 1 gram of glutamine daily and five for a lactose placebo. All had been out-patients previously and none had achieved abstinence. Three glutamine patients and three controls participated for three to five months. Apart from the glutamine or placebo, the patients continued with previously instituted psychotherapy and other treatment. No patient took disulfiram during the study.

None of the patients abstained totally from alcohol during the study period. In the three controls who participated, no essential change in alcohol use was seen. In the three glutamine patients, there was some evidence of enhanced ability to handle alcohol and a subjective sense of improved well-being. While no conclusions may be drawn from this small preliminary series, it provides indication for further investigations.

16. EFFECT OF PERTHANE ADMINISTRATION ON SPONTANEOUS MAMMARY CARCINOMA IN THE C$_3$H MOUSE. (Preliminary report.)

Louis A. Leone, M.D. and Henry B. Hahn, *Medical College of Virginia.*

Orally administered perthane given daily in the diet (11,000 parts per million) resulted in inhibition of spontaneous mammary carcinoma in all of 18 unbred C$_3$H females. One animal in this series was found to have subcutaneous sarcoma which metastasized to the lung. Animals receiving 6,800 PPM developed tumors in approximately 55% of instances while animals receiving 3,400 PPM or no perthane were found to have 80 to 90% spontaneous tumor formation. Preliminary histologic study of the adrenals suggests non-specific toxic alterations. Cytologic study of

vaginal cells suggest impairment of estrus cycle and microscopic examination of ovaries in the treated animals indicates impairment of follicle maturation and absence of corpora lutea. Although not absolutely defined by this study, it appears possible that perthane may inhibit spontaneous mammary tumor formation in the C_3H mouse by blocking hormonal stimulation through both the adrenal and ovary. Studies of the pituitary were not done but experiments are in progress for this purpose.

Marked increase in melanin pigmentation in coat and skin was noted in perthane treated animals. Silver stain revealed deep pigmentation in the basal layer and in the dermis. Survival time of animals receiving 11,000 PPM perthane was approximately 15% greater than in the control and 3,400 PPM groups. Adrenal weight, body length, and tumor size were not significantly altered by perthane administration. Animals in the low perthane group developing tumor, however, demonstrated a lower total number of tumors in the untreated groups.

17. THE EFFECTS OF X-IRRADIATION ON GUINEA PIG BRAINS WITH SPECIAL REFERENCE TO THE FACTOR OF AGE.

Burton A. Moss, Robert H. Brownson; *Medical College of Virginia.*

Certain cytological and histochemical approaches have been utilized to study the effects of x-irradiation on guinea pig brains. Two control and four experimental animals of identical age and sex were used in each age bracket. The various age groups were arranged approximately as follows: 1, 6, 9, 15, 28, and 62 months. All animals were fed on a special vitamin C fortified guinea pig chow. Each experimental animal received 1600 r total head radiation in a single exposure. Both control and surviving experimental animals were sacrificed after 32 days of latency. Control and experimental animals were anesthesized with nembutal sodium and sacrificed by perfusing with physiological saline-acacia followed by 10 per cent formalin physiological saline-acacia. The perfusion was made via the upper abdominal aorta under 76 mm. Hg pressure subsequent to cutting the inferior vena cava. The brains were then removed, halved by a mid-sagittal section and fixation completed in each half by immersion in two separate solutions, one of formalin, physiological saline and acacia and the other of acetic acid, formalin, alcohol and acacia. The quantitative data were obtained by using the cresyl violet staining technique.

18. MANOMETRIC DETERMINATIONS OF HYDRAZINE AND HYDRAZIDES.

Herbert McKennis, Jr. and J. H. Weatherby; *Medical College of Virginia.*

Isonicotinic acid hydrazide and a number of other monoacyl derivatives of hydrazine have been found to yield nitrogen readily when treated with an excess of iodate in the presence of acid. In contrast, diacyl derivatives do not yield nitrogen until at least one of the acyl groups has been removed by hydrolysis. It is possible to study biological acylation and deacylation by means of this iodate reaction. The determinations are conveniently conducted in the Warburg apparatus. Quantitative yields of nitrogen were obtained when known quantities of hydrazino compounds were added to blood, urine, spinal fluid and saliva. In agreement with the earlier work of Miller and Furman it is believed that many of the arylhydrazines are first oxidized to comparatively stable diazonium compounds. P-hydrazinobenzoic acid, for instance, yields nitrogen very slowly over a period of many hours. The rate of nitrogen liberation is a measure of the rate of decomposition of the intermediate diazonium compound rather than a measure of the initial reaction with iodate.

MINUTES OF THE

SECTION OF PSYCHOLOGY (10)

FRANK W. FINGER, *Chairman*

ROBERT J. FILER, *Secretary-Treasurer*

NOBEL MCEWEN, *Executive Committeeman*

RICHARD H. HENNEMAN, *Section Editor* (1959)

FRIDAY, MAY 10, 1957 – 1:00 P.M. – PARLOR D AND PARLOR E

1. THE INFLUENCE OF CONDITIONAL PROBABILITY, INTERPOLATED ACTIVITY AND STIMULUS SIMILARITY UPON RESPONSES TO SEQUENTIALLY PRESENTED STIMULI.

John B. Feallock; *University of Virginia.*

The present study tested the effects of stimulus similarity and interpolated activity upon the performance of a serial task which required the subject to remember previous stimulus events in order to respond appropriately to immediate stimuli. Conditional probabability, or the likelihood that stimulus B was preceded by stimulus A, was also manipulated as a means of reducing the interference usually associated with similarity and interpolation. Reinforcement of responses should facilitate learning conditional probabilities present in the sequence. Performance errors were expected to increase with stimulus similarity and with the number of interpolated stimuli; errors were expected to decrease with conditional probability and with reinforcement.

The stimuli consisted of three colored forms presented serially on a memory drum. The subject's task was to state the color of the previous figure with the same geometric form as the figure immediately before him. A 2 x 2 x 2 x 5 factorial design was used with two levels each of similarity, conditional probability, reinforcement, and five levels of interpolation.

Analysis of variance indicated that interpolation and conditional probability were significant effects as were the interactions of interpolation with both probability and similarity. It was concluded that conditional probabilities can serve to offset the effects of interpolation and of similarity.

2. THE EFFECTS ON RETENTION OF TWO MOTOR ACTIVITIES USED AS INTERPOLATED TASKS.

Albert M. Blecich and Noble R. McEwen; *Randolph-Macon College.*

The purpose of this study was to determine if there was more retroactive inhibition resulting from an "active" kind of motor performance than from a "mild" motor activity or from restful activity. The three types of interpolated activities were as follows: (1) a "violent" motor activity which consisted of a rapid game of basketball, (2) a "mild" kind of physical activity where a basketball was passed back and forth for ten minutes, and (3) social conversation along with listening to a musical recording. Three lists of fifteen nonsense syllables, matched in learning difficulty, were presented in serial order by means of a tachistoscope. Thirty college men were divided into three groups, each of which reported at the same hour for three different evenings. A counterbalanced design was used in the experimental method so that each group experienced the three kinds of interpolated tasks on different evenings of the same week. The results showed that a "violent" motor activity produced a greater amount of retroactive inhibition than did either a "mild" motor or restful type of interpolated activity.

3. IRRELEVANT STIMULI AND COMPLEX VISUAL DISCRIMINATION.

Milton H. Hodge; *University of Virginia.*

The present study sought to determine the effects of irrelevant stimuli upon complex visual discrimination when these irrelevant stimuli were relevent in other discrimination conditions. Several experimental questions were asked: does performance efficiency of a 16-choice task decrease as the number of irrelevant stimuli in the visual patterns is increased, does this decrement tend to decline with practice, does performance efficiency also decrease as discrimination difficulty of the relevant stimuli in the patterns is increased and do the effects of discrimination difficulty interact with the effects of irrelevant stimuli? Three conditions of irrelevancy and four levels of discrimination difficulty were employed. Thirty subjects were randomly assigned to one of the three irrelevant stimulus conditions; each subject was given all levels of discrimination difficulty. The geometrical stimulus patterns, previously photographed on 16 mm film, were projected automatically with a strip film projector. Each pattern was presented for 0.5 sec. The subject was required to respond by operating one of 16 switches during the 5.5 sec. interval before the next stimulus pattern was presented. Each subject practiced on the same experimental film for three consecutive days. Number of errors and latencies were the response measures. The results were analyzed by means of Lindquists' Type I factorial design. The results and theoretical interpretations will be discussed.

4. AN OLFACTOMETER FOR THE RAT.

Carl Pfaffmann; *Brown University* J. K. Bare; *College of William and Mary* and William R. Goff; *University of Virginia.*

A new behavioral method for the quantitative and qualitative study of olfactory sensitivity in the rat utilizes a bar-pressing apparatus mounted in a miniature wind tunnel. Through the tunnel passes a continuous stream of demoisturized and deodorized air, into which a specifiable concentration of odorous gas can be introduced. The rat is trained to press the bar continually into an odor-free atmosphere, and to stop pressing the bar when he detects an odor.

Data are presented showing the successful establishment of this olfactory discrimination, as well as some preliminary results obtained by this method in a study of the effects of bilateral ablation of the olfactory bulbs.

5. MOTIVATIONAL SUPPORT OF PERCEPTUAL HYPOTHESIS.

Charles C. Keach; *Alexandria Mental Hygiene Clinic.*

The "new look" in thinking about perception has emphasized the role of cognitive, central-directive, "ego" factors. Processes of "perceptual defense" have been hypothesized. There have been conflicting reports of the importance of stimulus attributes, of values and personality attributes generally of the subject, of motivating, stressful, or threatening task orientations, and of past experience as providing simply greater familiarity with stimulus materials or as influencing set or hypothesis strength.

This study attempts to evaluate through a factorial design the relative importance and interaction of stimulus character (hostile, non-hostile words), of motivational conditions (stress, non-stress), and of the personality attributes of the subjects (high, low need aggression) as influencing perception.

Four groups of twelve high school seniors were selected on the basis of need aggression scores from Edwards "Personal Preference Schedule." They viewed hostile and neutral words presented tachistoscopically under high stress and low stress conditions. Recognition thresholds, in terms of number of trials at constant shutter speed, and pre-recognition hypotheses were obtained as dependent variables.

Results are seen as supporting the perceptual defense hypothesis. Explanation of results in terms of "hypothesis strength" or of revised set theory is seen as beyond reasonable limits of complexity.

6. THE CHANGING ROLE OF THE PSYCHOTHERAPIST IN THE TREATMENT OF SCHIZOPHRENIA.

A. W. Jeffreys, Jr.; *Western State Hospital.*

Through Freud and the orthodox analytic movement, the stage was set for modern psychotherapy. The therapist's role was seen as passive and objective with the emphasis placed on the client and, especially, on the client's unconscious. While emphasis dealt with many of the neuroses, the method was not particularly beneficial in the treatment of schizophrenia. Neo-analytic and other schools now approach the treatment of maladjusted persons by dealing with the relationship established between the client and the therapist. The attitudes, defenses, values, etc. of both client and therapist become a vital part of the behavior dealt with during psychotherapy. The therapist no longer assumes primarily a passive and objective role, but becomes more of a distinct person engaged in an interpersonal relationship that hopefully provides the necessary milieu for learning.

Particularly in the treatment of schizophrenia this approach has been found, subjectively at least, to be relatively more effective in communication, in establishing a strong interpersonal relationship and in reinforcing realistic behavior.

7. CUTANEOUS ADAPTATION TO ALTERNATING CURRENT.

G. R. Hawkes; *University of Virginia.*

This study was an attempt to resolve differences among earlier studies of the adaptation of cutaneous sensitivity to alternating current. Frequencies of one hundred and one thousand cycles per second were used to study vibratory sensations, with the duration of the adapting stimulus ranging from fifteen seconds to three hundred sixty seconds.

An adapting current at a level of two times the unadapted threshold gave the following results, measured by threshold values immediately following the adapting stimulation: stimulation at a frequency of one hundred cycles per second showed adaptation to be slightly faster, with slightly greater loss of sensitivity and more extensive recovery time than when one thousand cycles per second was used. At both frequencies adaptation followed a negatively accelerated curve.

Differences between these results and those of certain of the earlier experiments may be due to the use of naive subjects in some instances, and, in other cases, to the use of different measures of adaptation.

Theoretical implications discussed include relevance of these results to the hypothesis that in these experiments the electric current is acting on cutaneous receptors rather than nerves.

8. DERIVED DIMENSIONS OF VIBRATORY STIMULATION.

William C. Howell; *University of Virginia.*

Recent experimentation on the feasibility of using vibratory stimulation as a means of transmitting encoded information has produced the following general conclusions: a) Using a tri-dimensional system based upon amplitude, duration, and spatial locus of vibratory stimulation of the chest, it is possible to transmit encoded words and messages accurately at better than 35 words per minute,b). The system selected for investigation is probably not the most efficient one available using these three primary dimensions, and c) There is at least one other primary and probably several derived dimensions of the vibratory stimulus which, if incorporated into a communication system, might greatly enhance the utility of such a system. The present paper is concerned with a persual of the latter possibility, the search for and evaluation of potential derived dimensions.

An analysis of many possible variations in the vibratory pulse was made and the most elementary one was selected for study. This dimension, which appeared to be involved in most of the more complex variations, was one of rate of increase from zero to maximum amplitude. To assess the information-carrying potential of this dimension, determinations of j.n.d.'s were carried out between the values of 0.03 and 0.19 sec. of rise for several widely-spaced intensities. The results were sufficiently encouraging to warrant proceeding to the next step, a determination of the number of absolute judgments possible along this dimension. Possibilities for other derived dimensions include variations in slope of offset, and of onset and offset combined.

9. MANIFEST CONTENT AND INTERPRETATIVE MEANING OF VERBAL INTELLIGENCE TEST RESPONSES.

Norman Tallent; *Veterans Administration Center, Kecoughtan.*

The observation was made that in clinical practice interpretations of manifest content are sometimes made in accordance with the "self-evident" or "obvious" meaning of such content. An example is the "theatre" item on the Wechsler-Bellevue Intelligence Scale, Form I, where, according to Rapaport, subjects who indicate they would yell "fire," if the first to discover a fire in a theatre, are impulsive. This hypothesis was tested by comparing the responses which were given to this item by three groups of boys who were designated as "well-controlled," "average" (in control) and "impulsive," on the basis of ratings on their overt behavioral control. The hypothesis was unsupported by the findings, nor could any other suggestive responses be found which differentiated the groups.

10 THERAPEUTIC VALIDATION OF THE *A* SCALE.

Dell Lebo, Robert A. Toal, and Harry Brick; *Richmond Professional Institute, Medical College of Virginia* and *Virginia State Penitentiary.*

The *A* Scale, a measure of manifest anxiety, is used in investigations of theoretical import. Hence, the scale itself deserves examination.

Versions of the scale frequently have yielded reliability figures above .80. Considering the dissimilar filler and critical items employed, this figure is assuring. Since such changes may influence anxiety, reliability should be reestablished whenever items are altered.

Validity is another matter. Originally the scale relied upon content validity. Validation has since been approached by other avenues. One road has been largely ignored, i.e., measuring, manipulating, and remeasuring an independent variable (anxiety) to determine whether differences in magnitude correlate with differences in scale scores.

The present experiment used the *A* Scale and Bender-Gestalt (B-G) as pre- and posttherapy tests for 24 overtly anxious prisoners divided into matched treatment and control groups. Therapy constituted administration of 30% CO_2 and 70% O2 by slow coma technique. The B-G served to check motivation to falsify *A* Scale responses.

Analysis by Festinger's distribution free method revealed scores on both tests significantly decreased following CO_2 therapy. Scores for the untreated group remained the same or markedly increased. The *A* Scale adequately reflected differences in the variable of anxiety.

11. NORMATIVE DATA FOR A MULTIPLE-CHOICE TAT.

John E. Williams; *University of Richmond.*

The Iowa Picture Interpretation Test (IPIT) is a group-administered, ten-picture, multiple-choice form of the TAT. The test yields scores on Achievement Imagery, Hostility, Insecurity and Blandness. Research has shown that these variables — particularly Achievement Imagery — are related to performance in a wide variety of experimental situations.

To date, all of the work with the IPIT has been done in college populations and no information has been available concerning non-college groups. This paper will present data comparing IPIT scores in three populations: male college students; male state prison inmates, and U. S. Navy Submariners. Although some significant differences are found, the general finding is that of similarity in the IPIT scores of the three groups. Observations are also made concerning the relationship of IPIT scores to certain non-experimental variables such as education, IQ and academic competence.

12. THE EFFECT OF RECITATION ON RECALL.

F. J. McGuigan, Allen D. Calvin, Martha M. Myers, and Elizabeth J. Hobbs; *Hollins College.*

In 1917 Gates conducted a widely cited experiment that led to the generally accepted conclusion that recitation increases efficiency in recall for both meaningful and meaningless material. The practical importance of this conclusion, and the limited amount of evidence that supports it, indicated a need for repetition of the experiment using contemporary experimental techniques.

The procedure followed was essentially that used by Gates. Fifty-eight students from two eighth grade classes were randomly assigned to one of five experimental conditions: 100% reading, 80% reading, 60% reading, 40% reading, 20% reading. Each subject was given one set of nonsense syllables and one set of biographical material on each of five days. Immediate recall and recall after four hours were measured.

Essentially the same procedure was also followed for thirty-eight college students, using three experimental conditions: 100% reading, 50% reading, and 20% reading. Nonsense syllables only were used and no delayed recall measure was made.

A statistical analysis of the results did not support Gates' conclusions.

13. FLEXIBILITY IN RELATION TO PROBLEM-SOLVING ABILITY.

William Battig; *University of Virginia.*

The retarding effect of what is variously termed inflexibility, rigidity, fixedness, sterotypy, or consistency represents one of the few relationships with any degree of generality in studies of human problem-solving. This is to be expected, since the presence of a variety of possible responses and the unlikelihood that the first response will be correct are among the defining properties of problem-solving, and most studies on this question have used problems in which flexibility was required for solution.

This paper is concerned with a problem in which flexibility had a somewhat different effect. The task required identification of words by naming letters of the alphabet, the objective being to find the word by naming as few letters as possible. Subjects proficient in this task were less flexible in the initial stages of solution from problem to problem, but became more flexible in the later stages, as contrasted with less proficient subjects. These results point up the importance of the specific characteristics of the problem in determining the role of flexibility. It appears that ability to become more or less flexible in line with the demands of the problem is related to problem-solving proficiency, rather than a general tendency toward flexibility.

14. "QUICKENING" TECHNIQUES IN IMPROVING TRACKING PERFORMANCE WITH A BINARY DISPLAY.

Patricia A. Rund; *University of Virginia.*

Man's tracking performance when error information is presented by a binary display system (e. g. two lights, two vibratory signals) has been found to be greatly inferior to that observed when information is displayed continuously (e. g. dial, cathode ray tube). This inferiority of performance is generally attributed to the fact that with a binary display, at any one instant, the only information the man has is the direction of his tracking error. Therefore, information as to the amount of error or its velocity and direction of movement is unavailable in the conventional binary display system. The results reported indicate that by modifying the display-control system so that man is provided with early knowledge of the eventual effects of his control movements ("quickening") and by *further modifying the binary display so that a switch in indication occurs not as a function of direction alone but as a function of the direction of error and its velocity* ("super-quickening"), adequate tracking performance can be obtained with a binary display system.

15. AN EXPERIMENT WITH COMPLEX VERBAL BEHAVIOR.

William E. Montague; *University of Virginia.*

This paper presents the results of an experiment proposed at the Academy meeting last year. The experiment attempts to demonstrate that what have been called hypotheses in concept formation and problem solving studies are complex verbal responses related to reinforcement in a fashion similar to simple verbal responses.

A matching-to-sample task was used which required subjects to make a choice between the form and brightness properties of geometrical figures in terms of a previous sample. "Hypotheses" were set up in the structure of the task. The subject's choice between form and brightness was made dependent upon the color or the size of the sample figure. In this way at one time the "correct" choice between brightness or form would depend on the color of the sample, and at another time the "correct" choice would depend on the size of the sample.

After the subjects had learned the "hypotheses" they were placed in a situation in which the "hypotheses" were differentially reinforced. The data obtained show that these responses are lawfully related to the reinforcement variable.

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[1] This research was carried out at the Naval Research Laboratory, Washington, D. C., under the direction of Mr. Henry P. Birmingham.

16. THE SELF CONCEPT AS A MEANS OF DETERMINING PERSONALITY TYPES IN A POPULATION OF DELINQUENT BOYS.

Cletus A. Cole; *Arlington County Schools.*

The basic problem of this research was to determine by statistical analysis of data relative to the self concept the "existence" of certain personality types in a population of delinquent boys.

In earlier studies reference has been made to various types of delinquents among which are the socialized delinquent and the unsocialized, aggressive delinquent described by Hewitt and Jenkins. Previous studies in this area have been more concerned with relating situational factors and types of crime to symptom patterns, and have employed for the most part case history material which was submitted to cluster analysis and traditional factor analysis (R technique). The present study, on the other hand, involved data relative to the self concept and employed a technique more suitable to the determination of personality types i. e., the "Q" technique. Subjects were obtained from the population at the National Training School for boys. Selection was based on a description of the two types desired for this study, namely the Socialized Delinquent and the Unsocialized Delinquent. Two independent behavior samples were drawn from each subject, and each of these sets of data was submitted to an obverse factor analysis in an effort to isolate specific groups. The results of this research indicate the existence of the two types of delinquents described by Hewitt and Jenkins, namely, the socialized delinquent and the unsocialized delinquent. Although types similar to those mentioned above were isolated by factor analysis on two different sets of data, the characteristics defining each factor do not appear to be specific to that factor alone.

MINUTES OF THE SECTION OF SCIENCE TEACHERS (11)

SAMUELLA CRIM, *Chairman*

VERA B. REMSBERG, *Chairman-elect*

MARTHA W. DUKE, *Secretary*

CAROLINE GAMBRILL, *Section Editor* (1959)

FRIDAY, MAY 10, 1957 – PARLOR F

1. CONSERVATION OF FISHERY RESOURCES.

L. A. Walford; *U. S. Fish and Wildlife Service.*

2. MOTIVATION OF THE SUPERIOR SCIENCE STUDENT.

Virginia Lewis; *Culpeper High School.*

We as science teachers are grateful for the increased emphasis which is placed upon science and the importance of science training today. The need for trained scientists and engineers is so great that the eyes of the people of the world are focused on the shortage in these areas.

In a recent issue of *The School Executive*, an article stated that 84 percent of the students enrolled in the secondary schools in 1900 were taking Science while only 54 percent of those enrolled in the secondary schools in 1956 were taking science. At a glance this situation would shake our confidence in our schools, but as we reflect on these percentages of today compared with those of 1900 let us remind ourselves of three points. First, while the population of America has doubled between 1900 and 1956 the number who take science courses has increased eight fold. Second, today we have 90 percent of those of school age enrolled in our secondary schools. A very small percentage of those people of school age were enrolled in 1900 because there was a very narrow curriculum and because there was no compulsory attendance law. Third, while 54 percent of those enrolled in secondary schools are taking science by a nationwide count the state of Virginia has approximately an average of 60 percent of those enrolled in the secondary schools taking science.

In answer to the frequent question, "How do we identify the gift-

ed?" some so-called experts would have us believe that an I.Q. of 135 or over is the only criterion for this identification. As teachers in the classroom, we know that the I.Q. of a student is merely one of the many indications of a student's ability and that there are students of such an I.Q. who will never be classed as superior because of their inability to get along with others, their inability to apply knowledge to new problems or their inability to adjust socially and emotionally. An effective study and identification of superior students in a school should include consideration of a student's results on such tests as science aptitude tests, intelligence tests, education achievement tests, and reading tests.

What are we as teachers to do to motivate superior students after they have been identified? Motivation activities will be classed as curricular activities and (or) co-curricular activities. Activities provide the opportunities for motivation and we as teachers make them "come alive" for the individual student. Motivation can be provided in two general ways for a majority of the schools. First by *enrichment* of the existing science subjects whereby opportunities are given to those superior students to delve more deeply into various areas of a class project. A second general method of motivation is that of acceleration. In this type of motivation care must be taken that a student is not accelerated through all of the science courses available in a school only to find himself in his senior year of high school with no other science course available. Special twelfth grade provisions should be made for those high school students who take biology in the ninth grade (rather than general science), chemistry in the tenth grade and physics in the eleventh grade.

Dr. Virgil Ward, Assistant Professor of Education at the University of Virginia, who has made valuable contributions through his studies concerning the gifted, suggests that a twelfth grade science course for those superior students who have been accelerated might deal with a historical background of science.

3. RECENT TRENDS IN THE TEACHING OF SCIENCE.
I. E. Wallen; *Science Teachers Program, AAAS.*

4. THE POSSIBILITY OF USING MARINE FORMS IN THE BIOLOGY PROGRAM OF OUR SCHOOLS.
Robert S. Bailey; *Virginia Fisheries Laboratory.*

Teachers working in the Tidewater area are urged to use marine forms to enrich their teaching. Animals indigenous to the region in which students live will attract their interest. Textbooks are general source books necessary in the classroom; their chief weakness is that they are general and often do not describe the particular animals that are common to the area in which the classes are being taught; use crabs when cray-

fish are studied, oysters when fresh water clams are studied, and local fish when perch or some other forms are studied.

Biology is the study of life, yet many high school class rooms have no living forms in them. Aquaria and terria using local forms should be introduced to every biology class room.

Fundamental concepts of biology, such as environment and adaptation can be studied on field trips to the river shore. A variety of habitats can easily be observed, such as piling habitat, seaweed habitat, open water habitat, and beach habitat. Food change can easily be illustrated with marine plants and animals. Algae to plankton, plankton to plankton feeders (such as shrimp and mollusks) and larval fish, and these forms in turn to larger fish.

Marine forms are useful in studying reproduction. Shrimp and crab eggs may be removed from the parents and held in open pans of seawater until they hatch. During the spring some of the fish are ready to spawn and this can be stripped from the fish and held in small containers and the embryonic development of fish observed.

Marine forms also lend themselves well to the study of classification, food values, regeneration and growth, and of blood circulation. Many are suitable for dissection, and on many of our beaches, fossil remains may be collected.

6. THE RESPECTIVE ROLES OF INDUSTRY AND EDUCATION IN THE ENRICHMENT OF SCIENCE TEACHING.

C. A. Thompson; *General Electric Company, Waynesboro.*

7. ATOMIC ENERGY DEVELOPMENT IN VIRGINIA.

W. C. Gumprich; *Babcock and Wilcox, Lynchburg.*

BUSINESS MEETING

At a short business meeting, the nominating committee, consisting of Franklin D. Kizer and Martha W. Duke, announced the following slate: *Chairman-elect*, Mae Jennings of Radford and *Secretary*, A. B. Niemeyer, Jr., of Craddock, as there were no nominations from the floor these officers were declared elected.

MINUTES OF THE
SECTION OF STATISTICS (12)

J. E. FREUND, *Chairman*
E. L. ENRICK, *Vice-Chairman*
C. Y. KRAMER, *Secretary*
P. N. SOMERFIELD, *Section Editor* (1959)

FRIDAY, MAY 10, 1957 — 9:00 A.M. — PARLOR G

1. SOME RESULTS ON CROSS-SPECTRUM ESTIMATION.

A. E. Garratt and J. E. Freund; *Virginia Polytechnic Institute.*

The cross-spectral density function may be estimated by

$$\Phi_{xy}(\omega_h) = \sum_{u=1}^{n} \left\{ x(t_u)y(t_u + k_u \Delta t)G_1(k_u) + iX(t_u)y(t_u + m_u \Delta t)G_2(m_u) \right\}$$

where the k_u are independently distributed according to $p_1(k)$, $k = -r; \ldots, r$; where the m_u are similarly distributed according to $p_2(m)$ and are independent of the k_u; and where $G_1(k_u)$ and $G_2(m_u)$ are arbitrary weight functions.

It is shown that the expectation of the estimator depends on the products $p_1(k)G_1(k)$ and $p_2(m)G_2(m)$, whereas the variance of the estimator depends specifically on $p_1(k)$ and $p_2(m)$. Various specifications of the products $p_1(k)G_1(k)$ and $p_2(m)G_2(m)$ and of the probability distributions $p_1(k)$ and $p_2(m)$ are considered which provide estimators with certain optimum properties.

2. SIMULTANEOUS PREDICTION LIMITS.

John J. Gart; *Virginia Polytechnic Institute.*

The assumption of a multiple regression model enables us to find I-α prediction limits for the dependent random variable, y, at a given value of the independent variables, $x_1, x_2, \ldots, x_p$ This is based on a t-statistic. If we wish to predict at k values of x, then the joint distribution of k such t statistics must be considered. This distribution is a straight-forward generalization of "Students'" t distribution and analogous to it in that it approaches the k-variate normal as the number of degrees of freedom becomes infinite.

In order to determine the true probability coefficient for a set of k such prediction limits, it is required to integrate this distribution over a hypercube centered at the origin with edges equal to 2f $\alpha/2$. As in the case of the multivariate normal, this is a very difficult problem. However, it can be shown that

$$1-k\alpha \leq \Pr(-t_{\alpha/2} \leq t_1, t_2, \ldots, t_k \leq t_{\alpha/2}) \leq 1-\alpha$$

for all degrees of freedom. When k=2 and the degrees of freedom are large (>10), existing bivariate normal tables can be used to lower this upper bound appreciably. Further approximation procedures as well as infinite series expansions for the integral are being investigated.

3. INTRA-BLOCK ANALYSIS FOR FACTORIALS IN TWO-ASSOCIATE CLASS GROUP DIVISIBLE DESIGNS.

Clyde Y. Kramer and Ralph A. Bradley; *Virginia Polytechnic Institute.*

Methods of incorporating factorial treatment combinations in group divisible incomplete block designs are given. The factorial treatment combinations are so matched with the basic treatments in the association matrices of the designs that the sums of squares for the factorial effects can be obtained as functions of the original treatment estimators.

It is shown first how a two-factor factorial may be incorporated into group divisible incomplete block designs. Single degree of freedom contrasts are obtained for the effects in much the usual way as for factorials in complete block designs. Multi-factor factorials and partial factorials are discussed, and a method of obtaining estimates and tests of significance of the effects is given.

5. THE STATISTICAL FOUNDATIONS OF CLIMATOLOGY.

H. C. S. Thom; *United States Weather Bureau.*

The science of climatology is a branch of meteorology which arose through the recognition of certain stabilities in weather fluctuations which could not be explained by pure physical reasoning alone. Observed climatological data series can be shown to be closely represented by ideal series of random numbers and hence the climatological variable can be assumed to be a random variable. This makes application of the calculus of the random variable valid and leads to stochastic models for climatological analysis which are in acceptable agreement with observation. This analysis furnishes the basis for climatological prediction which is shown to be a special case of synoptic prediction or weather forecasting. The stochastic processes of climatology are shown to have a physical basis. This is expressed by giving physical significance to the parameters of the probability function on the random variable and is the fundamental relationship of analytical climatology.

7. A MULTIVARIATE RANK-SUM TEST.

Leo Lynch; *Virginia Polytechnic Institute.*

An extension of the Wilcoxon-Mann-Whitney U-test to the case of two bivariate populations is considered. The test statistic is:

$$S_1 = \left[\sum_1^m u_A - \frac{m(N+1)}{2}\right]^2 + \left[\sum_1^m v_A - \frac{m(N+1)}{2}\right]^2$$

where

$\sum_1^m u_A$ = sum of ranks for the m observations on X_A

$\sum_1^m v_A$ = sum of ranks for the m observations on Y_A

and $$E\left(\sum_1^m u_A\right) = E\left(\sum_1^m v_A\right) = \frac{m(N+1)}{2}$$

$$m + n = N .$$

Keeping the u's and v's paired as given in the sample, m of

these pairs are selected at random and assigned to population A, while the remaining n pairs of ranks are assigned to population B. Under this randomization procedure, the mean and variance of S1 are derived. An investigation of the power of this test for specified alternatives is in progress.

8. ONE-WAY VARIANCES IN A TWO-WAY CLASSIFICATION.

T. S. Russell, *Washington State College* and R. A. Bradley, *Virginia Polytechnic Institute.*

In this paper, certain results previously presented by the authors are summarized and additional notes are added. To avoid repetition, we refer the reader to the abstract carried in the Proceedings (1955-56) of the Virginia Academy of Science, pages 358 and 359.

Considerable experience in use of the techniques developed has now been gained and the major emphasis of this presentation is to indicate the use of the procedures. Published data suitable for illustrative purposes recently appeared (Biometrics 12, 1956, p.p. 127-153, Kauman, Gottstein, and Lantican) and they have been used in the paper.

9. LINEAR DISCRIMINANT ANALYSIS.

R. H. Riffenburgh; *Virginia Polytechnic Institute.*

This paper is a population and large sample study of linear discriminant analysis for two populations. Two criteria for judging discriminators are presented, *viz.* (i) total probability of misclassification and (ii) maximum among probabilities of misclassification.

If A is a k-dimensional row vector of direction numbers, X a k-dimensional row vector of variables, and c a constant, the linear discriminator is $AX' = c$, a hyperplane in k-space. An individual is classified as being from one or the other population on the basis of its position relative to the hyperplane.

A and c are found for each criterion for unequal dispersion matrices where feasible and for proportionate matrices where not. Results for loss functions and prior probabilities are considered.

Certain comparisons among different discriminators are made. A simplification of a certain integral is given.

In the investigation of large sample theory, the estimate of P, $\bar{P}$, with the greater density within a region close to the parametric minimum

P may be considered the better $\hat{P}$. Comparisons are made for different $\hat{P}$'s and results are tabulated.

10. TRENDS WITHIN BLOCKS.

H. A. Still and R. A. Bradley; *Virginia Polytechnic Institute.*

This paper contains a theoretical study of the analysis of data for experimental designs which have underlying polynomial trends within each block. For example, in testing for treatment effects relative to the study of corn hybrids, there is sometimes a productivity gradient or a fertility gradient that must be considered. This gradient may be different within each block.

11. RANDOMIZED POWDER SPECTRUM ESTIMATION.

Willard O. Ash; *Virginia Polytechnic Institute.*

An important problem in the analysis of stationary ergodic Guassian processes is the estimation of the power spectral density function,

$\Phi(\omega)=\frac{2}{\pi}\int_0^\infty \rho(\tau)\cos\omega\tau\,d\tau$, where $\rho(\tau)$ is the autocovariance function.

The classical treatment of this problem is to estimate first $\rho(\tau)$ for various values of τ by systematic subsampling the process and then using numerical integration for an estimate $\hat{\Phi}(\omega)$. While the classical estimator can be shown to be biased, it has nevertheless proved to be adequate in many applications. It has the disadvantage, however, of requiring a sizable number of numerical calculations in order to produce a single estimate of $\Phi(\omega)$.

An attempt to get an estimator substantially as good as $\hat{\Phi}(\omega)$ but requiring considerably less numerical calculation has led to a new estimator for the spectral density,

$$\Phi^*(\omega)=\frac{1}{n}\sum_{i=1}^{n} x(t_i)x(t_i+k_i\,\Delta t)G(k_i),$$

where the k_i are independent and have equal probability distributions $P(k_i)$, and $G(k_i)$ are weight functions. It is shown that the bias of $\Phi^*(\omega)$ can be made the same as the bias of $\hat{\Phi}(\omega)$ by suitable choice of $G(k_i)$ and $P(k_i)$ and that the difference in the sampling variances of the estimators may be expressed as

$$\text{Var } \Phi^*(\omega) - \text{Var } \hat{\Phi}(\omega) = \frac{1}{n} \sum_{j=1}^{m} \left[P^2(O) + P^2(j\,\Delta t) \right] K^2(j) \left[\frac{1}{P(j)} - 1 \right]$$

where $K(j) = G(j)P(j)$. It was also discussed how to minimize the variance by a suitable choice of the probabilities and weights.

12. THE POSSIBILITY OF MONOZYGOTIC TWINNING IN MICE.

C. W. Clunies-Ross; *Virginia Polytechnic Institute.*

An outline of the program set up at Cambridge, England to investigate this phenomenon is given together with a brief discussion of various genetic problems in so far as they affected the problem in testing and estimating.

The probability distributions on both the hypothesis of no twinning and a hypothesis of some twinning are given. From these are derived tests of significance suitable for spot checks and final analysis; also estimation procedures, one of which embodies adjustments suitable for a wide class of minor genetic discrepencies between actual and theoretical distributions.

13. A METHOD AND ITS PROPERTIES FOR THE ANALYSIS OF RANKING IN TRIPLE COMPARISONS.

R. N. Pendergrass and R. A. Bradley; *Virginia Polytechnic Institute.*

The method of paired comparisons as developed by R. A. Bradley and Milton Terry is extended to the rank analysis of blocks of three. Different probability models for ranking three items are considered. From these a model that retains its form when the direction of ranking is reversed is selected for further investigation. Maximum likelihood methods are used to estimate parameters and likelihood ratio tests are proposed to test certain specified hypotheses. Some large sample results concerning the distribution of estimators and the power of the suggested tests are obtained. Power comparisons are made with such test procedures as those of paired comparisons and analysis of variance.

14. PROBLEMS IN RESIDENTIAL ANALYSIS.

Rudolf J. Freund; *Virginia Polytechnic Institute.*

Consider a regression equation of the form

The e is usually considered to be a random variable; it is this random variable which we minimize in the least squares estimation of the regression coefficients. But exactly, what is this "e"? Essentially it can be considered to be of the effects of a large number of other variables on the dependent variable y. In many cases there are so many of these variables and each has such a small effect that these effects can not be separated and are therefore lumped into the "error" or residual. There are however, cases when a part of this residual variation can readily be ascribed to certain factors. It is in such cases that an analysis of the individual residuals, that is ei, i = 1,2, . . . n, is both advantageous and desirable. Such an analysis on the ei can be used to determine not only the effect of other independent variables, but can also be used to determine insufficiencies of the regression model, such as the existence of non-linearities in the effects of the independent variables.

15. THE COMPARISON OF THE SENSITIVITIES OF SIMILAR EXPERIMENTS. PART I: THEORY; PART II: APPLICATIONS.

Ralph Allan Bradley; *Virginia Polytechnic Institute.* Daniel Eberhardt Waldemar Schumann; *University of Stellenbosch.*

The problem considered evolved from a need for means of comparing the sensitivities of two available experimental techniques. The experimental techniques may differ through measuring methods, experimental procedures, or evaluation systems. It is not always easy to establish differing experimental techniques, and this difficulty led to the research conducted.

W. G. Cochran discussed the problem of comparing differing scales of measurement for experimental results in a paper in the Annals of Mathematical Statistics in 1943. He considered cases where known or estimable relationships existed between observations on the two scales and posed the more general problems where such relationships were not known. The research required for the more general problems involved considerable mathematical complexity and no further publications have appeared since 1943. In this paper, we have considered the more general

problems and obtained results useful in a wide class of applications as noted below.

The approach to the comparison of the sensitivities of similar experiments developed here assumes that the research worker has conducted two comparative experiments in exactly the same way except for the difference in experimental techniques under study. In future research, he wishes to use the technique that has the greater sensitivity to the detection of effects of research significance. The methods of mathematical statistics developed permit a precise comparison of the sensitivities of the two experimental techniques without the requirement that there be an established mathematical relationship between observations from the two techniques.

Applications of the procedures developed are suggested in a wide area of research including taste testing, medical research, chemistry, life testing, and agronomy. Specific applications are made in two examples. One involves comparison of the discriminating abilities of judges in taste testing. The other uses data obtained by N. F. Murphy, J. E. Lastovica, and A. E. Skrzec, Virginia Polytechnic Institute in chemical engineering research. We are indebted to them for permission to use their data.

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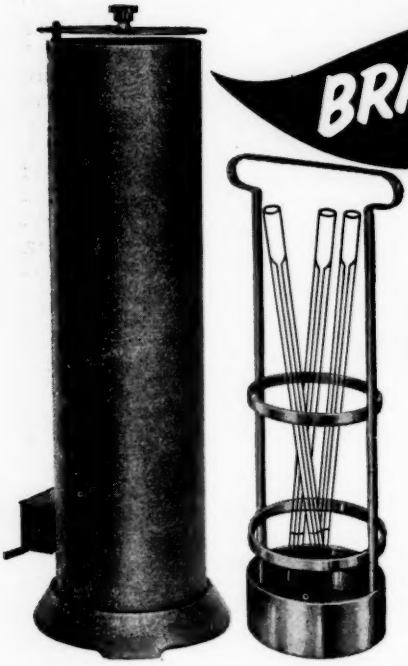

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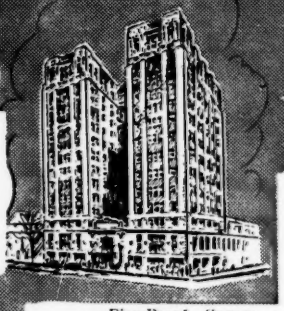

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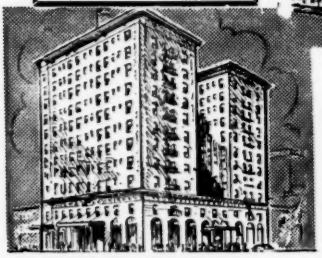

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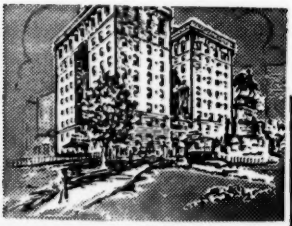

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